



SATURDAY, APRIL 6, 1872.

Langdon & Son's "Track Raiser."

The object of this implement is to raise rails which have become depressed by the settlement of the cross-ties from the weight of the trains which have passed over them. When that occurs it is impossible to tamp the ballast under the ties so as to raise the track permanently without first lifting it up so that the earth, gravel or stone can be rammed under them.

The construction and operation of the machine is, we



think, so obvious that they can readily be understood from the engraving. The advantage which is claimed for it over every other similar implement is its exceeding simplicity and the facility with which it can be operated. It is only necessary to place it in the proper position in relation to the track, and then attach the hook to the base of the rail. One man by throwing his weight on

Foote & Randall's Printing Telegraph.

The advantages of a telegraph transmitting apparatus which can be operated by any person of average intelligence, after a few minutes' instruction, is sufficiently obvious without further comment. Every man can thus be his own telegraph operator, and railroad conductors, locomotive-runners, clerks or office boys can quickly become expert in the use of the instrument.

Our engraving represents a very simple instrument of this kind, which has been designed by Messrs. Foote & Randall, of New York.

The receiving apparatus is entirely automatic in its action. A train of wheels and weight is employed to drive a type-wheel, which is controlled by a simple and positive escapement. The escapement is controlled by

station or stations to which it was sent, thereby dispensing with a receiving operator or the constant attention of any one to receive the dispatches.

In the transmitting apparatus, as in the receiving apparatus, a train of wheels is employed; but in this case they simply drive or turn the circuit-wheels.

The speed and regularity with which the circuit-wheels move is governed by a centrifugal frictional governor, which is a very simple and complete arrangement; by it the speed may be varied from 10 to 100 revolutions per minute, and, at whatever speed it may be set, it is regular and steady—an essential point in an automatic transmitter.

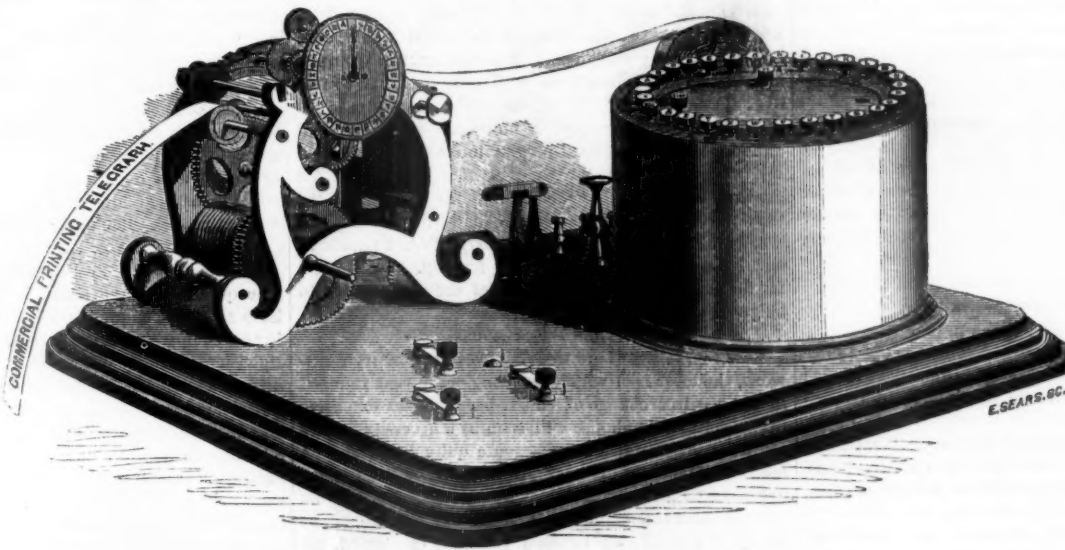
From the circuit wheels impulses are made and broken over a line, an impulse being sent for every character upon the type-wheel, and starting from the blank or

electrical impulses, either from a local or a line battery. There are thirty characters upon the type-wheel and thirty teeth upon the escape wheels. A pin upon a lever acts upon the teeth of said escape wheels in such a manner that the type-wheel is allowed to rotate with a step-by-step motion when the said lever moves to and fro.

This lever has attached to it an armature (a piece of

unison key (allowing the circuit-wheels to turn) by simply depressing the lettered keys, the letter upon the key depressed is instantly printed at the receiving station or stations, and any one of average intelligence can operate correctly after a few minutes' instruction.

The Commercial Printing Telegraph Company, Nos. 75 and 77 Spring street, corner of Crosby, New York,



the end of the lever can then raise any part of a track sufficiently to enable the repair-men to tamp the ballast under the ties.

The inventors state that "on a single line of track one man can handle this lever and raise for sixty or more men to tamp, and do it easily. Two men can raise yard tracks and switches from a compact bed of several years make, if not frozen."

Its simplicity, and the facility with which it can be handled, commend it for the purpose for which it is designed.

Messrs. William Langdon & Son are the sole proprietors and patentees. Their address is Burlington, Iowa, and Erie, Pennsylvania.

—The trains on the Belleville & Southern Railroad have been stoned lately, and the lives of the passengers endangered, by a gang of scoundrels near Pinckneyville. Two men were arrested in the act, and, while being searched by the City Marshal, one of them drew a knife and stabbed him, inflicting a wound 13 inches long, whereupon the Marshal shot the desperado dead, which, perhaps, is the best use that can be made of men of that kind.

soft iron) which is suspended between two electro-magnets, and the to and fro movement of the lever is affected by the attraction of the armature to first one, and then the other electro-magnets, alternately, as impulses of electricity are passed over them. Therefore, an impulse over either magnet moves the lever one way, and, the type-wheels turning, a letter is presented to the paper upon which the impressions are made.

As impulses may be sent very rapidly over a wire, and as the lever has but a slight movement, the speed at which the type-wheel revolves is very great, and the printing is effected about as rapidly as one can touch the keys of the transmitting instrument.

The printing is effected with a local battery.

A very complete and important part of this instrument is its unison mechanism, which is automatic in its action, and by which the sending operator may instantly set all the instruments in unison (at a given point) at will, thereby positively controlling all the instruments in the circuit, and by its use may be positive that all messages sent correspond with the copy before him (which will have been printed while sending), and received correctly and automatically by the receiving instruments at the

will give any further information that may be desired concerning this instrument.

Stamping Boiler Plate.

The boiler plate manufacturers of the Atlantic States, at a recent meeting in Philadelphia, adopted a resolution to the effect that the manufacturers decline to fill any orders for iron required to be made and stamped as prescribed by sections 36 and 37 of the steamboat act of February 28, 1871, and to urge Congress to amend the act so that stamping of the tensile strength of each plate may be left to the option of the manufacturers. They complain that in case of an explosion of boilers, they might be held criminally responsible.

Secretary Boutwell, in reply to the communication addressed to him, states that the provisions of the act are directed against false stamping, as is executed by design, and no variation between the tensile strength indicated by a stamp and that actually found in a plate after use and after the explosion of a plate could be taken as sufficient evidence of intentional false stamping to sustain an indictment.

—The Illinois Legislature has passed a bill authorizing the organization of companies for the purpose of building union depots and station-houses.

Contributions.

NOTES ON THE MANAGEMENT OF AMERICAN RAILROADS.

BY A HINDOO.

[CONTINUED FROM PAGE 136.]

The first general meeting of the "Western and Southern Railway Association" was held at St. Louis on January 16, and adjourned to meet again at Atlanta, Ga., on April 9. The election of such a man as Mr. Thos. Allen, President of the St. Louis & Iron Mountain Railroad Company, to the presidency of the Association, gives promise that railway management will be discussed with greater freedom and in greater detail than we have hitherto found recorded. In his inaugural speech, Mr. Allen said: "In my experience more scientific light is needed in the detail of railroad conduct." Truth to say, not many members appeared anxious to say much, and a resolution passed that "members communicate with each other by circular" did not look much like business. Of course much could not be expected from the first convention, as no subject had been fixed beforehand for discussion. The Association can accomplish this much good, at any rate, that managers can discuss and agree to generally adopt measures which any one of them would not care to see introduced on his road only, especially if it be in the nature of a stricter discipline, which might create a feeling of dissatisfaction among his men. For instance, some time ago I addressed several managers regarding a plan I had devised to check conductors in the matter of collections in cars. As a preliminary, I wrote inquiring if they wished to take up such a plan. Several did not reply at all. A few asked for further particulars. A majority wanted to know what other managers thought of it, and if it was in use on any road. Some who received the further particulars thought it a good plan, but would not like to introduce it unless other roads would do so. This is just how it is that discipline is so very lax on nearly all roads. No managers care to be unpopular. Any stringent measure they think would drive away their best hands. In such matters the Association may do much good by enabling members to adopt simultaneously such action as all might think good, but none be willing to initiate. Such an association is necessarily powerful, and may perhaps be regarded as antagonistic to the welfare of employees. But if the members appreciate the interests they represent, they will combine only to eliminate bad practices and bad characters, and to raise the moral and intellectual standard of the employees by making the profession a desirable one. Every attempt to oppress the servants makes the service less pleasant and less sought after by those who respect themselves. Every determination expressed to discard the worthless gives a renewal of vigor and of hope to the industrious and the able. As yet the association has given no sign of its policy. The subjects discussed were:

1. Abolishing the system of commissions on tickets.
2. The abolishment of the pass system.
3. The interchange and proper charges for cars.
4. A system of mutual rates.
5. Employment of hands discharged from other roads.
6. Responsibility of railroads for injuries done employees.
7. The best method of guarding against accidents.

No resolutions were come to on these questions, and they were placed on the programme for the next meeting. The question of passes was also taken up, and also a discussion entered on regarding conductors and collections. Conductors were in the main complimented and the matter shelved.

There appears no reason to expect managers to do otherwise than compliment the men they have themselves appointed, nor is there any reason to suppose that conductors are more rapacious or any worse than the ordinary run of men. The true issue is: Is it right to continue a system that places before men such temptation as we know average humanity cannot resist, a system by which an unknown sum of money daily is intercepted on its way to the treasury; and then the question follows: What better plan can we adopt? Surely the Association can produce something better than the present crude style of doing things. Probably members do not desire that their views on such a subject shall become known to their men, and therefore do not come forward.

FREE PASSES.

This question seemed to be most interesting to all members. Managers are greatly exercised when they contemplate the fearful number of passes issued during the year. The total must be reduced, but how to compass it is the difficulty. The weakest must go to the wall; so no more passes shall be granted to employees, except upon application from the head of a department in the

business of the company. Such a policy may reduce the number of passes issued, but is not a sign of good management. A man who has left the service of a company has no claim to a free pass over any road; he is no longer an employee; but so long as he remains in the service of any one road, good policy teaches that he should be assisted in every way possible. If they have to pay fares, few railroad men can afford to travel. A refusal to give passes, therefore, benefits the treasury but little, whereas every one given benefits the recipient very much, being to him a real value; and as it is each company's best policy to give to its servants as much as possible of such one-sided value, all the roads should reciprocate employees' passes. The Western and Southern Association gives no promise yet of such a liberal policy, although the franks to Congressmen, editors, lawyers, *et hoc genus omne*, will probably flow freely as ever. The man worth thousands of dollars who is not ashamed to beg for five dollars will get them. The tried servant, whose wife wants to visit a friend on a neighboring line, when he asks for the same boon, will be told that the rules forbid it. Indeed, on many roads the passes are grudgingly doled out for families traveling on the home line only. Return stock and "business" passes should be done away with. It remains to be seen whether the new agreement will be adhered to any closer than former ones of the same tenor. Such passes are in reality a reduction of freight at the expense of the coaching department, are false in principle, and useless as a means of attracting traffic. I have known some managers out West agree with competing lines not to give return or business passes, and then send out men to canvass, with authority to give such passes secretly, and when accused of it they boldly denied the fact, or sought to shift the responsibility to the shoulders of a subordinate. Such practices are inconsistent with the positions they hold, are not advantageous but rather the opposite to the interests they are paid to foster, and are dishonorable in the extreme. If the members of the Association will strive to remove such stains from their body by insisting on an honorable adherence to agreements, by exposing and expelling those who are proved guilty of such practices, holding them up to scorn, that body will raise itself in the estimation of its employees as well as of the public doing business with it.

INTERCHANGE AND CHARGES FOR CARS.

It is high time to place this on a better footing. Mile age charges do not meet the requirements of the case. I have known foreign cars allowed to remain under load while every nerve was strained to relieve home cars. Not infrequently foreign cars on their homeward journey are stopped and loaded back with local freight by some over-zealous agent. A reasonable charge should be made for the first twenty-four hours, say one dollar, and an increase in geometrical progression for every succeeding twenty-four hours, or part thereof, say one dollar for the first, two dollars for the second, four dollars for the third, eight dollars for the fourth, and so on, except in case of a break-down, when the charge should remain at one dollar per diem for the first fortnight, two dollars for the second, and so on, notice of the disablement to be given at once.

CAR CLEARING-HOUSE.

Now that railroads are weaving over the country a network, the meshes of which are being every year reduced in size, the interchange of cars is becoming so extensive that a car clearing-house will soon be a necessity. Cars are frequently returned by a route quite different from the original one, and sometimes wander off to regions unknown to their owners. Such vagaries give trouble to every road interchanging cars. A car clearing-house would, at a small cost to each company concerned, arrange all such matters and secure to each road its fair share of demurrage.

ENGAGEMENT OF EMPLOYEES.

This is an awkward subject to handle. It has always been difficult, if not impossible, to get any number of managers to keep to their agreements in this respect. Some suppose that managers should pledge themselves not to seduce each other's men. Such a proceeding would not suit this country and is at best a short-sighted policy, injurious in its effects on the whole body of the profession. Few railroad officers see beyond the apparent immediate interests of their own lines. They do not look to the improvement of the whole body of employees. Each one strives for himself. Of course there are exceptions to this rule, and several roads, notably the Chicago, Burlington & Quincy and the Great Western Railway of Canada, have gained a reputation for behaving well to their servants. Some roads have agreed not to employ men dismissed from any of the roads in the compact. Such action has been taken in view of the movements of the old society of locomotive engineers. This is a matter that cannot be dealt with in a few words. I shall therefore leave it for the present. Any rules the Western and Southern Association can agree upon

and keep to prevent the employment of men discharged for bad character, drunkenness, etc., will be a measure of justice to the hard-working and industrious class. Every man leaving the service of a road should be furnished with a certificate showing the length of service, capacity employed in and cause of leaving, which latter should be stated fully and honestly. No manager should engage a man professing to have railroad experience without this certificate. A man discharged for drunkenness, dishonesty or gross neglect of duty should not be re-engaged, on any account. Not that it is desirable to punish the man, but that it is necessary to avoid him. Acts such as these are outcroppings of an unreliable character, one that is totally unfitted for the duties of a railroad employee, and the sooner such a man learns the fact that railroading is not in his line, the better for all parties. In this country, a conviction for petty dishonesty and for breach of trust costs much trouble and is somewhat uncertain; consequently, few cases are prosecuted. I have known several men dismissed because their accounts would not bear scrutiny and for drunkenness; yet they were engaged on other roads within a short time in improved positions, while honest, unassuming men, equally competent, toil on in inferior positions from year's end to year's end. Such practices should be righted. If managers would refuse to engage men in responsible positions without references extending some time back, and if they would advertise their wants, so as to have a larger number to select from, the tone of their employees would be speedily raised. Instead of which, now they select, more especially on new roads, from inferior commodities close at hand, or from men loafing around, who were probably dismissed from another road in consequence of some peccadillo. I would not be understood to say that all men going around looking for work are loafers or bad characters. Many are lopped off in reduction of establishment; some have lost their places rather than lose their self-respect; some ambitious ones leave, striving to better themselves in the Far West; some are honest and smart, but are of a restless, discontented spirit, and as such are not worth much. If the plan of advertising in a paper of general circulation among railroad men, the RAILROAD GAZETTE for instance, were generally adopted, the ambitious ones need not leave their places until they are offered fresh engagements. Or if managers think that the plan of advertising would be too costly, or the trouble of looking over so many applications too great, let them agree to support a bureau of employment, giving it a demi-official character. All desirous of being employed could there register themselves, depositing their testimonials. A manager applying for a certain class of man could be suited at once, with the certainty that he is getting an industrious, sober man, with some experience. Track could there be kept of each applicant, so that as soon as a man committed a disgraceful act, he could be marked down and would know at once that he had better seek some other field of usefulness.

RESPONSIBILITY FOR INJURIES DONE TO EMPLOYEES.

A settled policy on this subject is highly desirable. The question, I apprehend, is not whether employees have a right to compensation, but it is whether the giving of compensation is good or bad policy. As to the right, it may fairly be argued that when a man engages on a railroad he knows the hazardous nature of the duties he engages to perform, and in consideration of a certain salary he accepts the risk of injury, and is therefore not entitled to any compensation. On the other hand, it is argued that the man engaging undertakes only such risks as are unavoidable, and does not take upon himself the consequences of gross neglect, either of employer in providing imperfect machinery, or of his fellow-workmen. This is the view generally taken by the courts. For instance, a brakeman moving among the cars was run over and lost a leg. The driver had started his engine without giving the usual notice by whistle. Heavy damages were given by the court. The general policy hitherto appears to have been to refuse all but a very small compensation. Appeals to the courts are only taken by a few dogged individuals, and mostly end in arbitrary damages being given against the companies. In pursuance of the policy which I have advocated throughout, of making the railroad profession as a whole desirable and reliable, an understanding should be come to that adequate compensation will be given in every case of injury. In the event of total disability short of death, which is of rare occurrence, the man should receive a pension sufficient to provide him with the necessary comforts of life, and his family should be provided for as soon as each member becomes fit to earn a livelihood. In cases of partial disability, employment in a suitable capacity should be assured him for life. In case of death, the family should be provided for by being given employment, or if too young for that, by a pension until of age to earn a living. The mother of the family could proba-

bly be employed in some capacity, so that she might earn at any rate part of the allowance. With proper care to provide suitable employment the total amount paid in pensions on each road would not be very large; for such allowance must not be luxurious, but only sufficient to prevent want of the necessities of life. A judicious system such as this, embodied in rules and subscribed to by every man taking service, would preclude appeals to court and demands for excessive damages. It would also remove that feeling which now exists among railroad employees, that their masters have no consideration for them, but seek to get as much work as possible for as little remuneration as possible. Such a feeling begets a similar want of consideration for the employer's interests, which results in pecuniary loss to the latter.

[TO BE CONTINUED.]

THE SOUTHERN ROUTE TO THE PACIFIC.

NUMBER SIX.

SAN FRANCISCO, March 20, 1872.

In the last paper the great grama grass region of the mid-continent was described; in this I shall have somewhat to say of the country along the Gila and its tributaries.

The San Simon is the first Pacific stream, but it is not running in summer, and it never is of sufficient strength to groove any considerable depth of channel for itself along the middle of the vast plain through which it courses. Even late in the summer rainy season it is nothing but a series of puddles of yellow water, ripped in the tough grama sod. And here one notices conspicuously a difference between California—which has no sward as it is understood in the Eastern States, which leaves its streams free to gouge out the deep gulches for which it is famous—and the grama region, with its deep-rooted, tenacious turf.

Next west is the San Pedro, which flows through a plain about twenty-five miles in width, at a depth of 200 feet or more below its level. The plain itself has a thin, hairy coating of grama grass; but the rich bottom lands would yield a heavy swath to the scythe, besides here and there patches of the gigantic Sacaton grass which sometimes conceals the head of a rider on horseback.

It is this Sacaton grass which has occasioned one of the jokes usually cracked at the expense of Arizona, that about "cutting hay with a hoe;" and in the Government advertisements for hay contracts it is expressly stipulated that "no hay will be accepted which was cut with a hoe." The San Pedro bottoms are about a mile wide, of deep and rich sandy alluvium, and capable, with the summer rainy season and a certain amount of assistance from irrigation, of producing two crops annually. When we passed there was a little settlement seven miles below the emigrant crossing, where were produced barley, wheat, corn, all kinds of vegetables, etc. We saw and ate some very large melons and roasting-ears grown there, which were of an admirable quality. The settlement has lately been massacred by the accursed Apaches.

The San Pedro is a rapid, clear, cool stream, carrying a good body of water all summer, sufficient at least for the irrigation of its own valley. The valley is said to be blessed with a salubrious climate, rather sultry on account of its depth, but not afflicted with fever like Tucson.

From the San Pedro diagonally across to the Gila it is a distance of about 120 miles—a desert nearly all the way, of which that part lying between Tucson and the Gila is called the Ninety-mile Desert by way of distinction. Emigrants usually take this desert and Tucson in their way, but the Government beef-contractor told me he always pushed his herds right down the San Pedro, and so down the Gila to the Pimo villages, finding a good bite of grass nearly all the way.

This long desert above-mentioned is about twenty miles in width, and is bisected diagonally by two little brooks, the Cienaga and the Santa Cruz, both of which soon sink in the desert, though they furnish each a narrow strip of good grass, say eight or ten miles long. With trifling exceptions, the San Pedro plain is the last body of grass worth mentioning until you reach Warner's Ranch in Southern California, 400 miles distant, though a portion of the cattle live through somehow. Tucson is the metropolis of a desert, and the Gila valley, even on the Pimo Reservation, has practically no grass.

Tucson is a scurvy town as ever was. A little stripe of bright-green grass, half a mile wide along the Santa Cruz, runs diagonally across the desert, and partly on the green, partly on the dust-colored plain, with chaparral in its very streets, is the mud-colored blotch of the territorial capital. Its narrow, crooked streets are full of deep, floury dust, and dogs and wooden-wheeled Mexican carts, with three men to drive one yoke of oxen sometimes. It is hot, very hot; there is no ice; the atmosphere is full of fever and the countenances of the Americans are pallid

and thin; often for days together there is no fresh meat in the shambles, and no bacon even.

In the immediate vicinity of the town the narrow valley is well cultivated, being partitioned off by willow and cottonwood hedges into little squares, which grow remarkably full of corn and vegetables, considering they are cultivated by Greasers. Although it sinks in the desert about three miles below town, the Santa Cruz supplies the inhabitants at present with water, irrigates perhaps a hundred acres of ground, and drives a flour-mill a few miles above town. Most of the wheat here cultivated is the Sonora variety, which makes a bright yellow flour and very heavy bread. There seems to be no life in it, no heart, no lightness; for our cook, though making usually tolerably good bread from Texan flour, could never induce the Sonora flour to rise.

Let a man go three miles west of Tucson, and the Apaches will hang him up by the heels in a mesquite bush, pull off his scalp, and make a fire under his head. And yet the merchants of that town will advance seed and implements to a ranchman who seems to mean business! In fact, southeasterly, toward the old city of Tubac, about the foot of the Santa Rita Mountains, and around the great cathedral of St. Xavier del Bac, there is a considerable body of good land, partly occupied by the friendly Papagoes, whose presence renders it tolerably safe. The merchants of Wickenburg and Prescott will do the same, and they have better inducements, for along Salt River, the Salinas, Green River and some others, there is more arable land. I was told of a man who, taking his life in his hand, ventured out alone and ranched one year on Salt River, clearing \$17,000 on a single crop of barley! The reason for this exceptional great profit was the exorbitant price which the government is compelled to pay for barley for the supply of its trains.

On the Ninety-mile Desert there is far less grass than on the Llanos Estacados, even in the wet season, and there is nothing to interest us there except a peculiarity of soil. Though very slightly alkaline, if at all, in the dry season it yields such a prodigious quantity of dust that one horseman cannot see another sometimes at a distance of ten feet. On the other hand, in the rainy season it becomes a perfect slush, almost as soft as wet snow, so that even a man will frequently plump down knee-deep. As in Eastern Texas, along the Sabine in places, a horse frequently seems to mire down easier on the rising ground than on the lower.

The Pimo Reservation is 25 miles long by four wide, and is a veritable oasis in the desert. Who can tell how many hundred years, without cessation and without manuring; it has produced crops to civilized men? Even from those times which lie far back and beyond the mystical "seven cities of Cibola," those times which were contemporary with "sacred Aztlan," a thousand years ago, perhaps more. Even within historic times, in those years when the old Jesuit cities of Tubac and Tucson were opulent and populous, enriched by the gold mines of Arizona, now just rediscovered; when their Indian neophytes were numbed by tens of thousands, and the great cathedral of San Xavier del Bac was built, to remain to this day a wonder and an amazement to the traveler in the desert; and when long *conductas*, laden with gold and precious stones, threaded their way across the desert to the City of Mexico—then the population of this oasis was very great. And to this day, even after the terrible Apaches have laid waste the ancient Aztec cities of the plains for two hundred years, and swept all the Jesuits away hundreds of miles down into Mexico, and hemmed in the Papago neophytes within a little circle around that cathedral to whose venerable walls they yet look up with touching devotion, and which they would die to defend from the accursed nomadic infidels—even yet this oasis maintains a population of twenty to the square mile, or thereabout. The remains of irrigating ditches, the sites of vanished villages, the immense amount of broken pottery scattered everywhere over it, point to a European density of population. The fact that the two little colonies, one of Pimos and one of Papagoes, were alone able of all the ancient occupants of the plains to stem the fierce torrent of Apache invasion which swept far down into Mexico, attests the strength of these wheat-fed populations, for it is contrary to the precedents of history that a lowland people should worst mountaineers, as the Pimos do to this day when they choose.

After so many hundred years, therefore, this remarkable and historic ground remains substantially unimpaired. It is the rich, warm, silt-laden waters of the Gila, conducted over it in numberless *acequias*, that have kept it up. The Pimo wheat is pretty and plump, but not of a first-rate quality, and seems to need a renewing of the seed, as they have doubtless sown the same without change for centuries. Such vegetables as they plant do well, especially melons and pumpkins. They have a few horses, some of which are very pretty Spanish jen-

nets, but most of them are like Indian horses in general; but they pay no attention to swine and cattle, except to knock emigrant cattle in the head when they are bogged down, without waiting to see whether they could be released or not.

This single oasis, when it is open to white settlement—and, unfortunately, the Pimos will disappear very fast before the vices introduced by a freer traffic, for they are lapsed from their former proverbial virtue—will maintain eventually a population of 15,000 or 18,000 souls.

Of the valley below the Pimo Reservation it is difficult to say anything good. The eyes of the traveler are wearied, palled and disgusted with the endless swamps, lagoons and pools of alkali. Here and there is a sweet spot where the pools of rain-water are potable for cattle, but for the great part it is one of the most dreary and dismal deserts I ever beheld. The soil is good enough, and there are sometimes broad and generous expanses of it, but all sodden, burned and deadly poison with alkali. In the deep, narrow ravines of the plains there often grows a good swath of gaita grass (pronounced in Arizona, *guyetta*), closely related to grama grass, and greatly prized by the station-keepers for the stage-horses. The few inhabitants, too, unless they live close beside the river, are obliged to go back to the plains for water, which they occasionally find in little tarns of sweet water, in the deep, gravelly ravines. The richness of the soil is attested by the mesquite trees, which here grow sometimes to the diameter of two feet, or even thicker, but so squatly as to furnish only one length of railroad ties. Indeed, they sometimes split open with their own sheer weight, and the enormous branches grovel helplessly on the ground in three or four directions, growing along like sweet-potato vines. There are many cottonwoods close beside the river, but everybody knows how little value they have. The jungle is often very dense, and the ground under the trees is frequently covered with a green mold. As you approach Fort Yuma the stinging, sweltering, sultry day is deadly; an old inhabitant tells me he has seen a little bird, in attempting to fly across the river, fall dead down through the air. At noon, even in September, when the rainy season has cooled the air a little, all nature is still, and there seems to be no breath in all the heavens. You beat and winnow the air in vain, it seems no cooler than before. Even the gluttonous ravens, which I saw fly miles together across Colorado Desert, sit in the bush or on the ground and pant; the coyote will scarcely get out of your way. For days together we traveled with our heads close-wrapped in our handkerchiefs and our hands thrust into our pockets, to keep them from the countless millions of mosquitoes. Down near Fort Yuma at night there blows over now and then a cool whiff from California, but twenty or thirty miles up this does not reach. And there you must lie, with your head tight-wrapped in the blankets or handkerchiefs, with the infernal singing around you, getting such breath as you can through the miserable, accursed nights. The inhabitants build their houses close beside the river—where the mosquitoes are less troublesome—clear away the jungle for some distance around them, if they have enough energy, to remove the lurking-places of the vermin, surround them with a very wide and dense bush-canopy as a kind of cellar, hang up all their entables in little bags to keep them from the ants, and then wheel their beds about under this canopy wherever they can find the coolest corner. Every night they fill a huge olla with water, and suspend it by the neck in a moistened swathing of gunny-cloth, so that next morning the water is a little cooler than the river.

And yet, strange to relate, this valley of hell is healthier than Tucson. The inhabitants state that they seldom have fevers, and of the ten or a dozen families below Gila Bend I saw no one sick in any degree. It is possible that the alkali exercises a kind of antiseptic effect on the atmosphere.

One thing more before we cross into California: Many a man has told me that his eyes were nearly ruined by alkali dust in crossing the plains by the northern route; but I have yet to find one so complaining who crossed by the southern. Most of the alkali on the latter is along the river, where it is damp and does not fly.

STEPHEN POWERS.

The "Neat Problem."

TO THE EDITOR OF THE RAILROAD GAZETTE:

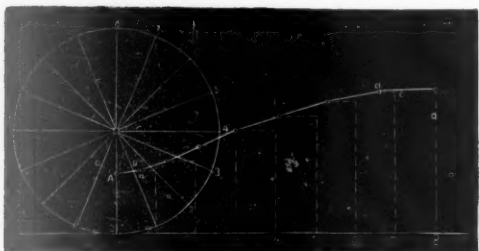
Allow me to offer a solution to your neat little problem of January 6. The path described by the center of the crank-pin is not in reality a cycloid, but is the combination of a cycloid and lineal direction, and the whole space traversed by the center of the crank-pin during one revolution of the driving wheel is equal to the length of the cycloid curve plus this lineal distance, which is equal to $4 \times 2 + (15.708 - 0.283) = 8 + 9.425 = 17.425$ ft. The lineal distance equals the difference in the circumference of the driving wheel and the circumfer-

ence of the circle which the crank describes. The driving wheel makes 336.13 revolutions per mile, therefore $336.13 \times 17.425 = 5,857$ feet, or nearly the distance the center of the crank-pin traverses. "EUREKA."

Pittsburgh, March 12, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Permit me to offer the following solution of your question of January 6, which has been appropriately called a "Neat Problem."



Suppose the 5-foot driving-wheel to have sixteen spokes, the center of crank-pin being in the center line of one spoke.

Let fall a perpendicular on the center lines of the other spokes from the center of the crank-pin. The right angles thus formed will be of use in determining the position of the crank-pin at different points in the revolution of the wheel.

Set the wheel with the center of crank-pin directly below the center of the axle.

Lay off the rail into spaces corresponding in length to the spaces rectified between the centers of the spokes on the circumference of the wheel.

Now, as the wheel rolls forward, the angle $AB1$ will assume the position $a b 1^1$, the length of the line $B 2$ showing the height of the pin from the rail, and the line AB its distance back of the center of the axle; both measurements giving the exact position of the pin in space at this point in the revolution.

The position of the pin at the time each spoke comes in contact with the rail being thus obtained, the several positions may be joined by straight lines, whose aggregate length will be approximately that of the curved line described by the crank-pin in one revolution of the wheel, viz., 16.37495 feet.

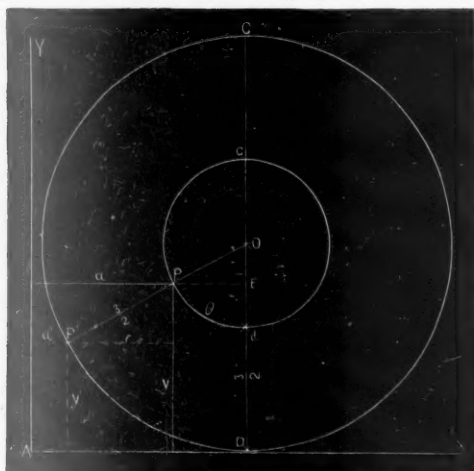
Revolutions in one mile, $336.134 \times 16.37495 = 5,504.177$ feet, the length of the line traversed by crank-pin in one mile.

W. L. N.

Cleveland, O., March 13, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

To determine the length of the curves described by the pencil in the center of the crank-pin, we will refer it to



two co-ordinate axes, AX and AY , AX being tangent to the bottom of the drive-wheel CDP , and P identical with A at the starting point, or the arc $DP = DA$. cdP is the path of the pencil P with reference to the center O , θ the arc Pd ; (a, y) , (a', y') , the ordinates of P .

The point P describes the well-known curve called the cycloid. The equation is

$$a' = \frac{1}{2}(\theta - \sin \theta), y' = \frac{1}{2}(1 - \cos \theta).$$

From the figure we get

$$a = a' + \frac{1}{2} \sin \theta, \theta = \frac{1}{2} \theta - \sin \theta.$$

$$y = ED = \frac{1}{2} + (1 - \cos \theta).$$

Differentiating a and y , we get

$$\frac{da}{d\theta} = \frac{1}{2} - \cos \theta, \frac{dy}{d\theta} = \sin \theta.$$

Denote the curve by s , we have

$$\frac{ds}{d\theta} = \sqrt{\left(\frac{da}{d\theta}\right)^2 + \left(\frac{dy}{d\theta}\right)^2} = \sqrt{\frac{1}{4} - \cos \theta + \sin^2 \theta} = \sqrt{\frac{1}{4} - 5 \cos \theta}$$

I am not able to integrate this expression; we will, therefore, divide by the $\sqrt{5}$ and expand the binomial

$\sqrt{a - \cos \theta}$ where $a = \frac{1}{4}$. We find for $\frac{1}{\sqrt{5}} \frac{ds}{d\theta} =$

$$\sqrt{a - \cos \theta} = a - \frac{1}{2} \frac{\cos \theta}{a} - \frac{1}{8} \frac{\cos^2 \theta}{a^2} - \frac{1}{16} \frac{\cos^3 \theta}{a^3} - \frac{5 \cos^4 \theta}{128 a^4} - \frac{7 \cos^5 \theta}{256 a^5} - \frac{21 \cos^6 \theta}{1024 a^6}$$

Integrating between the limits $\theta = 0$ and $\theta = 2\pi$ when $\sin \theta = 0$, $\frac{s}{\sqrt{5}} = 2\pi \left(a - \frac{1}{16 a^3} - \frac{5}{128} \cdot \frac{3}{8 a^5} \right)$

$$= \frac{105}{(16) 3 \times 2 \times a^{\frac{1}{2}}} \text{ etc.}$$

For one revolution of the drive wheel

$$s = \frac{3.1416 \times 400}{20 \sqrt{5}} \times \left(\frac{20^2}{20} - \frac{1}{16} - \frac{5 \times 3 \times 1}{128 \times 8 \left(\frac{3}{8} \right)^2} \right)$$

$$= \frac{105}{(16)^3 \times 2 \times \left(\frac{3}{8} \right)^{\frac{1}{2}}} - \frac{100 \times 149}{(16)^3 \times 2 \times 256 \times \left(\frac{3}{8} \right)^{\frac{1}{2}}}$$

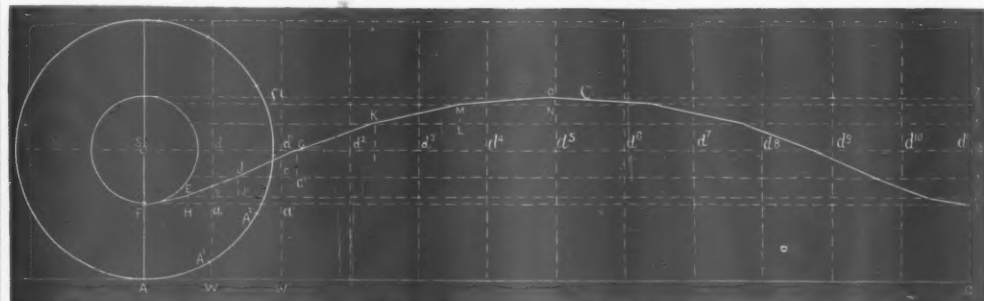
= 16.337 feet, if we take five terms of the infinite series. This will give for the curve described in one mile 5,491.52 ft. = 16.337 ft. \times 336.14, which is correct, with the exception of the .14 in the 336.14, the curves not increasing in one revolution uniformly with θ ; but the error is slight, being sometimes less and sometimes more than the average quantity given, depending upon the position of the pencil at the moment of starting.

M. L. MARCY.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Inclosed you will find what I think is a correct solution of the problem given to the men of the Northern Pacific Railroad shops.

SA is the radius of driving-wheel; $SF = \frac{1}{2}$ stroke. Divide the circumference of the driving-wheel, and also the circle described by radius SF , into any number of equal



parts. I have divided into 12. Lay off on AQ 12 spaces equal to arcs $A^1 A^1$, $A^1 A^2$, etc. At the end of each space erect perpendiculars. When the wheel has advanced so that A^1 falls on W , then F is somewhere on line No. 2, and at the distance SF from d , which gives E . In like manner J, G, K , etc. are found.

Circumference of 5-ft. wheel = 15.708 ft.

$$\text{Number of revolutions} = \frac{5280}{15.708} = 336.13.$$

$$\frac{1}{2} \text{ of circumference of driving-wheel} = 1.31.$$

$$\text{Angle subtended by arc of } \frac{1}{2} \text{ circumference} = \frac{360^\circ}{12} = 30^\circ.$$

$$\text{Nat. cos. of } 30^\circ = 0.86603 = b d.$$

$$\text{Nat. cos. of } 60^\circ = 0.50000 = c d^1.$$

$$a b = 1.00 - 0.86603 = 0.13397.$$

$$a^1 c = 1.00 - 0.50000 = 0.50000.$$

$$E b = \sqrt{1^2 - 0.86603^2} = 0.5.$$

$$H F = 1.31 - 0.5 = 0.81.$$

$$F E = \sqrt{0.81^2 + 0.134^2} = 0.918.$$

$$c J = \sqrt{1^2 - 0.5^2} = 0.866.$$

$$J^1 E = 2 \times 1.31 - (0.81 \times 0.866) = .944.$$

$$J^1 J = 1.00 - (0.5 + 0.13397) = 0.366.$$

$$E J = \sqrt{0.944^2 + 0.366^2} = 1.03.$$

In a similar manner, JG, GK, KM and MO are found. Their sum is $8.282 \times 2 = 16.564$ = length of line described in one revolution. $16.564 \times 336.13 = 5,567.657$, the answer.

H. S. MADDOCK.

Port Deposit, March 16, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Taking radius of circle described by the crank-pin as 1 foot; then circumference of the circle = $2\pi \times 1.416 = 6.2832$ feet. In each revolution the crank-pin describes a cycloid with a base of 6.2832 feet.

Periphery of a cycloid = four times the diameter of generating circle = $2' \times 4 = 8$ feet.

$$\text{Number of cycloids in one mile} = \frac{5280}{6.2832} \text{ feet.}$$

$$\text{Length of line traced by pencil} = \frac{5280}{6.2832} \times 8 \text{ feet} = 6,723 \text{ feet.}$$

March 17, 1872.

HINDOO.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The numerals in the figure indicate five positions of the

crank-pin that occur during one revolution of the driving wheel, the first one being at the dead point on that side of the center opposite to the direction of motion. The path of the crank-pin during one revolution is a reversed curve of the transcendental class, having two branches described in equal times, but differing in length and degree of curvature; the lengths of chord, respectively, are the semi-circumference of the driving wheel, plus and



minus twice the distance of the center of the crank-pin from the center of the axle. The general equation of the curve applicable to all points of both branches is

$$x = Ru + \sqrt{y^2 + r^2} \cos^2 u - r \cos u.$$

The origin of the axes of co-ordinates being at the initial point of the curve, as represented in the figure by the numeral (1); x and y are co-ordinates of the curve; large R represents the radius of the driving wheel, small r the distance from the center of the axle to the center of the crank-pin, and u the length of an arc to a radius of unity, which, commencing at the axis of abscissas measures the angular motion of the radius of the driving wheel, and also of the crank-pin. In testing the applicability of the foregoing equation, it should be remembered that the algebraic sign of $\cos u$ in the first and fourth quadrants is positive, and in the second and third quadrants is negative.

In the proposed problem the approximate lengths of

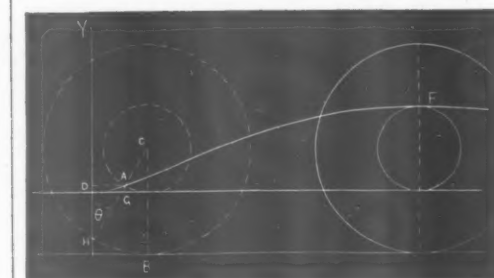
the two branches of the curve formed during one revolution are respectively 10.32 ft. and 6.05 ft., and in running one mile the length of line generated would be 5,502.45 ft. The relative position of the crank-pin and center of axle at starting and stopping would produce some variation in the length of the line.

A. H. C.

Liberty, Ind., March 15, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

$AG = y$ and $GD = x$ $AD = s$
 θ = variable arc to radius unity, measuring the angle be-



tween the radius through the generating point and the axis of Y = angle AHD = angle ACB . Also $AC = r$ and $BC = a$.

Then we have:

$$x = a\theta - r \sin \theta$$

and

$$y = r \text{ versin } \theta$$

and

$$dx = (a - r \cos \theta) d\theta$$

and

$$dy = r \sin \theta d\theta$$

But we have:

the differential of the arc $ds = \sqrt{dx^2 + dy^2} = d\theta \sqrt{a^2 + r^2 (\cos^2 \theta + \sin^2 \theta)} = 2ar \cos \theta$, putting in values of dx and dy .

But

$$\cos^2 \theta + \sin^2 \theta = 1$$

∴

$$ds = d\theta \sqrt{a^2 + r^2} = 2ar \cos \theta$$

$$= d\theta \sqrt{p^2} = 2ar \cos \theta,$$

when we let $a^2 + r^2 = p^2$, for brevity.

If this be expanded into a series by the binomial theorem, and integrated between the limits π and 0, we obtain:

$$s_{\pi=0} = \pi p - \frac{\pi a^2 r^2}{4p^3} - \frac{15\pi a^4 r^4}{64p^5} - \frac{4725\pi a^6 r^6}{11520p^7}$$

Now if, in this formula, we make $a = 2.5$ and $r = 1$, then
 $p^2 = a^2 + r^2 = 7.25$
 and $p = \sqrt{a^2 + r^2} = 2.6926$
 $\therefore s = 8.45907 - 0.2513 - 0.02803 - 0.00583$
 $y = 2r = 2$
 $s = 8.17391$
 and $s = 2 \times 8.17391 = 16.34782$
 $x = 2ra$
 \therefore distance traveled by crank-pin in a mile
 $\frac{5280}{15.708} \times 16.34782 = 5,495.1$ feet
 $\frac{5280}{15.708} = 336.13$, and, for absolute accuracy, we ought to integrate separately for the .13 between the limits θ and 0; that is, between 0 and θ when $x = .26\pi a$; $x = .13 \times 2\pi a$
 however, the difference in the result would be exceedingly small, much less than would result from carrying out the series one or two places further, though that would be very small also. '72 CORNELL.

THE SAFETY OF TRAIN DISPATCHING.

TO THE EDITOR OF THE RAILROAD GAZETTE:

This stirring up of train dispatching that your correspondents are indulging in is certainly both timely and needed.

There is no more vitally important branch in railroad-ing, and probably none that heretofore has received so little attention, outside of the officials directly concerned.

Let us hear all sides, drawing what wisdom we can from each. If the good points of the different systems can be gathered together and the poorer ones discarded, we may secure substantial benefits. Meantime, while we all wish to see the real faults of our present systems criticised and improved, they should have no more burden to carry than belongs there.

As train dispatching is but one of many assistants in railroad-ing, we must not expect too much from it. Called into life by necessity, its first use is to insure safety to life and property; afterward, to use the roads' facilities to their utmost extent, thereby economizing in rolling-stock, time, etc.

Any system that will not avoid blockades is of no earthly use; for no matter how safe it may be, it is impracticable.

"A Hindoo," in your February 3d number, gives us the India system, commending it highly. In your March 2d number he indorses it still stronger, and slashes right and left into all other systems. While the systems in use here are not claimed to be perfect, would the India system do at all? Even in India, "A Hindoo" found it necessary to take "a bird's-eye view, and stepped in when necessary to stay the progress of any train so as to avoid those jams and complications."

Here the question is not when a dispatcher should "step in," but when he can step out. Preventing these jams is the hourly, almost momentary, call upon his judgment. To do it his plans must be laid long in advance, and often changed over and over again, as necessities require. Some one train breaks in two, slipping rail or something else delays it, rendering the change necessary. As "A Hindoo" objects to our orders: will he tell us what forms of orders he used, and what precautions he took in the emergencies he refers to? It strikes me "A Hindoo" has fallen into the error of thinking that because there is no one system of train-dispatching adopted, in all particulars, upon all roads in this country, therefore we have no system.

While there would be some little advantage gained in a general system, it is necessary that all roads in this country, with their widely different requirements and necessities, should have the same particular set of rules? Would it not be better to make the rules fit the particular requirements than to attempt making the requirements fit the particular rules?

In the GAZETTE of February 17, "X." gives a few rules very similar to ours. Under them, during 1870, this company ran over one division, forty miles in length, twelve of which at the eastern end has a double track, 5,318 passenger and excursion trains, 4,440 regular freights with 125,982 cars, 2,694 extra freights with 80,368 cars, 87 empty engines, 26 pay-car trips, and construction trains equaling 387 trips over the entire division, without an accident of any kind. I think "A Hindoo" will admit that this proves a system of some kind. Would the Indian system, with each train as it arrived coming under each station-master's orders, have done as well? With the selfishness common to all mankind, would not these station-masters, in endeavoring to keep their own tracks comparatively free, become indifferent as to others and decline to give "line clear" permits? I fear that in this country, where suits for damages, especially against railroad companies, are so easily commenced, before the freight was fairly over the road judgments for delays would have eaten up more than the transportation profits.

March 2, "A Hindoo" asks "What internal checks

the American system provides." While I consider there is no thoroughly established "American system," I think the rules given by "X." show a fair system of checks. In his precaution No. 1 (same date), he says: "The two telegrams are then indorsed 'O. K.' by the operator, signed by him, and at last given to the conductor." Where duplicate orders are given, one is to the engineer, the other to the conductor.

Is he not wrong again in his criticism of this precaution? This repeating back of orders is one of the internal checks he asks for. It is not because the order is so "complicated" or "enigmatical," but to be absolutely certain it was correctly transmitted, that no lightning had knocked out, or added to, the order a dot or dash, and to insure that the conductor reads the operator's writing correctly. The conductor's understanding is not always a verbatim copy of the order, but given in his own language, conveying, of course, the meaning of the original order, or (another internal check) the operator notices the discrepancy, or, passing him, the dispatcher sees and corrects it.

Again, "If the receiver after entering the message in his book." With us the receiver has no book, but copies the order directly from the instrument upon the identical train-order blank which is afterward, when indorsed "O. K.," delivered to the conductor. Without this "O. K." it is no order at all, and the conductor will no more run upon it than he would on any other waste paper. If he should, whether with or without an accident, he alone is in fault. The message is not an order until it is "O. K'd."

Again, in criticising precaution No. 2, "Ans. 31" is not telegraphed back; it is a rule printed upon the blank, in plain view of the conductor, is of no additional expense, and simply precautionary. Again, where "No. 1 has the right of way, at station B, gets an order to pass (meet?) No. 2 at C." (Trains with even numbers always run in opposite directions from trains with odd.) This example will hardly do. If No. 1 has the "right of way," No. 2 cannot be near C unless run there by the dispatcher, who always holds No. 1 first.

Meeting points, where there is no telegraph office, are as safe as any others; but, one train being disabled, the other must wait at that station until flagged to the next telegraph station for further orders.

Again, "Example No. 2." "C. replies held, but forgets to turn on the signal, being either half asleep, or not himself." Now C., when he says "held," means it. Not a promise to hold in the future, when the train comes along, but that he has already turned his signal before he replies, "Held." Let me here copy the rule bearing on this point:

"When an operator receives an order to hold an engine or train, he must first put out the green signal, and then reply, 'I have such engine or train held.' Be careful to observe that the signal is not disturbed or hidden, and notify promptly all other trains that the signal is not for them. This green signal must not be relied upon exclusively to hold trains. Operators are expected to watch closely for the expected train, using all necessary means to stop it. In case the train, or any part of it, has already passed the telegraph office, although still at the station, operator's understanding must not be sent back until the engineer or conductor has been shown the order, and understands that he is held."

Again, "Example No. 3." To apply to this road, the order would read: "Do not pass B until ten-forty (10:40) unless No. 2 is there." This is a shorter order, equally plain, and the figures spelled out first, then duplicated in figures (another internal check).

At 10:45 (not 10:40, as five minutes are allowed at all meeting points, whether made by telegraph or not) No. 2 not being in sight, No. 1 would start out and find No. 2's flagman and torpedoes a safe distance out, precisely as if the train had been running on the card, without telegraph orders.

That there have been cases of forgetting no one can deny; but a dispatcher who is not overworked, and who properly realizes his responsibilities, will not forget.

If a railroad company uses false economy in selecting cheap men instead of the best and most faithful for dispatchers, or in the requisite number of them to avoid overwork, it must pay the price; and if its "operating expenses" are unreasonably high, they should charge the excess where it belongs, and not upon their dispatching system. B.

TRAFFIC MANAGEMENT.

TO THE EDITOR OF THE RAILROAD GAZETTE:

That part of railway management which relates to the movements of trains, to which you have of late given considerable prominence, is undoubtedly of very great importance, deserving the most careful consideration of railway managers, involving as it does the safety of life and property; but, strange to say, it is very much less

thought of than many less important questions of management. The system which at present prevails on nearly all of the lines in the country, of regulating the movements of trains off time from one office, and by men whose sole duty it is to overlook the line through the telegraph and give the necessary orders to avoid delays or accidents, is not in itself a bad one; at least I know of none by which a crowded single line can be more effectually worked, although I have no doubt the system advocated by your "Hindoo" correspondent could be advantageously adopted on many lines where the traffic is limited. Leaving, then, for the present, the question of system, or rather change of system, out of consideration, and assuming that the ordering of trains by train dispatchers could hardly be superseded on our great lines, it remains to consider what are the defects or dangers now apparent, what difficulties have arisen or are likely to arise through the present mode of dispatching, and what additional checks or safeguards may be applied to insure greater safety without detention. A mistake which seems to lie at the very threshold of train dispatching is, that a perfect knowledge of telegraphing is a *sine qua non* for a dispatcher, the idea, in fact, being pushed to such a length that I have frequently known reckless and unsteady young men, whose only qualification was a knowledge of telegraphy, intrusted with the ordering of trains, when steadiness and ability without telegraphy have been available; and although many reliable dispatchers are expert telegraphers, no doubt the mind which is occupied with arrangements affecting the safety of human life should not be distracted by purely mechanical operations. Another defective arrangement would appear to be, on many lines, the indefinite and irresponsible people to whom orders affecting the movements of trains are addressed; sometimes it is the conductors, again the enginemen, then it is the station-masters, and on one line the switchman who is responsible. Of this latter absurdity the writer had personal knowledge, and took some pains to demonstrate the absurdity and difficulty, not to mention the danger, of requiring a pointsman to vacate his post, which should never be done, to agree to hold a train, which in the event of a crossing being made subsequently for another station he could not do, and indeed could not be expected to do; nor could a train be delayed until the concurrence of a pointsman in a new arrangement could be obtained. The result was exactly as the writer had foreseen—the affixing of signatures to messages which had never been obtained, and telegraph operators, often young lads, taking the responsibility, which in some instances has resulted disastrously. Another defect in the system, and one which managers overlook, is the dangerous and destructive habit of running heavy freight trains at a very high rate of speed to make sharp crossings. A freight train has been delayed by extra work at stations; to meet an express which happens to be a few minutes late the dispatcher asks if the run of ten or fifteen miles can be made in such a number of minutes; and on an affirmative reply, which is always made, the order is given and the track for the distance is pounded and the cars badly shaken by driving a heavy train at the insane rate of forty miles or more an hour. Sometimes, as the writer has known, after some delay the brief intimation goes to the superintendent something to the following effect: "Off the track; ten cars in the ditch, badly broken; cause, supposed broken axle," and the oddest thing of all is, however serious an accident may have been, a court of inquiry and a rigid examination into all attending circumstances is never made. When a collision occurs in consequence of one train overtaking a preceding one, it will rarely be the fault of the dispatcher. I have, however, known of several collisions caused by dispatchers ordering forward a train which should have been held, forgetting a previous order, and this danger being urged as a defect in the system, which indeed it is, I shall presently suggest a mode of avoiding the risk of forgetfulness where forgetfulness might entail the most dreadful consequences. In addition to the employment of reliable men as dispatchers, it is also important that the men intrusted with the execution of the train orders should be trustworthy, and as at large stations, or at night at smaller ones, the telegraph operator is frequently intrusted with the sole charge of the execution of most important instructions, great care should be taken that this functionary be reliable as well as competent; as a matter of fact, however, the latter qualification is alone considered. A case at this moment recurs where, a night telegrapher being required at a station of considerable importance, and such appointment being made by subordinates without reference to the superintendent, a child was sent for the responsible place. He was, he said, twelve years old, but was told to say he was thirteen; and regardless of protests, on account of his extreme youthfulness, he was retained to order forward trains which should proceed and hold those which should

not—and doubtless with less risk to life and property than in the case of many unsteady men similarly employed.

These, then, are some of the defects at present existing in this branch of railway management, and I shall now briefly consider the remedies which suggest themselves. To insure safety in ordering trains it is not sufficient that only the station-master at the station where the train having right of track is to be held should be advised, but the conductor, and, through him, the engineman of such train should also be notified, and should acknowledge such notification; and, to enable this to be done without detention to either train, the dispatcher should be able to foresee an impending arrangement, and secure the train having right of track before its arrival at the station where the crossing is to be made. This early arrangement would also avoid hurrying freight trains—a most mischievous and destructive habit, and one which will go further toward accounting for the short life of iron rails, over which managers and presidents raise periodical wails, than any other cause. These officers write long reports to the directors for the semi-annual meetings, complain of the badness of the iron being furnished by rolling mills, enter immense sums for renewals; living in so high an atmosphere, they never hear or know of the stereotyped conversations constantly occurring: "Ask Bill if he can make Slabtown in twenty minutes." "I'll do it if I bust'er," replies Bill; and so the evil is unchecked and the cause of the dreadful wear and tear undiscovered.

I have known several instances of trains having been ordered forward which should have been held for approaching trains, through forgetfulness of a previous order, and this danger it is claimed is the weakness of the system. No doubt very serious accidents have occurred from this cause; but instead of condemning the system, it would seem a better plan to apply a remedy. If it were possible to place before a dispatcher, in some way, the result of every movement ordered—a sort of register, as it were, of all the trains on his division—instead of trusting so much to memory for what has been done, no doubt much greater safety would be insured; and this registration is, I think, quite feasible. I would suggest, then, a miniature railway in the dispatcher's office, a *fac-simile* of the division he is working, showing gradients, sidings and all the peculiarities of the line. Every train moving could be shown, its number and position indicated, and its fixity when required insured by a thumb-screw. A dispatcher would run no risk of sending one train in face of another, and as crossings could only be made at the stations, a glance would show what trains would meet and the probable points, and crossing arrangements could often be made with a view to subsequent meetings as well as to those at the time pressing.

This idea may seem to some chimerical, but that it is not altogether novel many superintendents who have boards with holes and pegs representing trains to assist them in the compilation of time cards will bear me witness. Another illustration, if more should be required, will be found in the celebrated game of battle played by Prussian officers with miniature battalions, which are moved to different parts of the field as the commanding officer directs.

J. H. McNAIRN.

LATROBE'S Z RAIL.

ANOTHER "COINCIDENCE."

A few weeks ago we copied from the *American Railway Times* an engraving of a section of a compound rail which, we undertook to show, was not new, but had been proposed and put into practical form several years ago. At the same time we stated the objections which had been urged against it, and suggested a modification which was proposed by the writer, and which it was thought was more practicable than either of the others. This suggestion he supposed was original, and to tell truth he rather congratulated himself on its brilliancy. Our readers may conceive of his dismay on receiving a letter accompanied by a lithograph—from which the above engraving was made—and a descriptive pamphlet of almost exactly the same device, which was proposed and put into practice by Benjamin H. Latrobe, C. E., more than thirty years ago. The writer has but one consolation left him, which is that "great minds think alike."

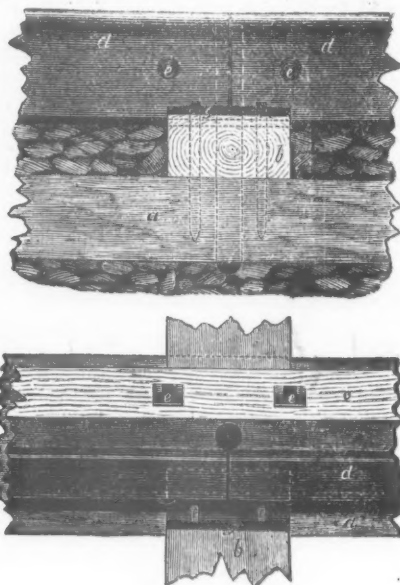
The following is Mr. Latrobe's letter:

BALTIMORE, March 22, 1872.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your number of March 16 are some judicious remarks under the head of "broken rails," upon which I would offer a suggestion or two. While it is quite true that the weight of a rail, assuming it to be well proportioned for strength, stiffness and good wear, should be in proper ratio to the rolling weights it has to carry, there is a limitation which should be kept in view. If the sleeper or cross-tie bearings (never more than 3 feet between centers) were all, absolutely unyielding, the

lightest rail ever in use would be superfluously strong; but the fact is that when a rail breaks it nearly always breaks over one of its supports, which yields more than the two adjacent ones on each side of it. The unsupported or but partially supported length of rail becomes thus doubled, and if two contiguous cross-ties give down it is trebled, and either bending or fracture becomes inevitable. Now the lighter rail will bend more readily than the heavier, and so follow its yielding supports and be saved by them from fracture, while the heavier and stiffer rail would break. Within certain limits, therefore, the lighter rail would be the safest, especially if it be made equally strong with the heavy rail at the joints by an effective system of splicing, which it may be, as all rails are about equally weak at those points; indeed the heavy rails relatively are the weaker. The track resting upon a road-bed which, however well drained and ballasted, is of very variable consistency, is really a very flexible structure, as any one will see who will watch it from one side with his eye upon the level of the rails while a train is passing. If it were otherwise, there would have been no end of broken rails upon the old unballasted roads and those still dependent upon the natural soil for support. The ability of the rail to bear its load, is, in truth, dependent upon the laborer who rams the broken stone gravel or earth under the cross-tie, and if he packs one a little less hard than the two on each side, he increases the length of bearing to a greater or less extent. Rails, therefore, must continue to bend, and the most we can do is to keep them from breaking, if that be possible; or, if they do break, to save the consequences, which, as you observe, are so increasingly disastrous, as the experience of the past winter has shown. The compound rail composed of two or three pieces, would reduce the danger of fracture to a minimum; but all compound rails seem to be under ban, and so nothing need be said, I suppose, in extenuation of their admitted defects. The best safeguard against fracture of a solid rail would be a continuous timber beam, but that too has been condemned,



and if placed underneath the rail, perhaps justly. As an auxiliary lateral support, however, I think it not obnoxious to the same objections, and I take the liberty of sending you a memoir upon a form of rail which I designed some thirty odd years ago and which was laid in 1845 with a weight of 30 lbs. per yard upon one of the roads in the Cumberland coal basin and did good service there for many years. Several modifications of this form of rail, which I named the "Z rail," from its peculiar shape, have been since proposed by various parties, without any reference to my original suggestion of it, and one of them quite recently. None, however, have taken with engineers, any more than my own, which might have been received with more favor but for its requiring a continuous wooden outside support. The splice patented by J. R. Trimble, Esq., and which I have always regarded as, upon the whole, the best which has been proposed, embraces the same principle, but is confined to the joints and applied to the ordinary form of T rail.

The memoir now sent was republished, in part, in one or two of the professional periodicals about the time it was prepared, but did not elicit much notice; nor do I suppose that it would excite much, if any, interest now. Still, if you think it, or any extracts from it, worth occupying any part of your columns in a dearth of other matter, it is at your service for that purpose.

BENJ. H. LATROBE, Civil Engineer.

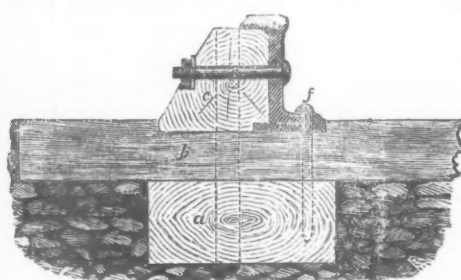
From Mr. Latrobe's pamphlet we copy the following: The track now described will consist of the longitudinal under-sills* (a, a) 5x10 inches in section, with cross-ties (b, b) 3x6 and 7 feet long placed upon them at intervals of 3 feet from center to center, and upon the cross-ties, notched one inch deep to receive them, will rest the string-pieces (c, c) (of the trapezoidal section shown) 3 inches wide at top, 5½ at bottom and 5 inches deep. A treenail, 1½ inches diameter, is driven vertically through the three timbers at each cross-tie, excepting the ties on which the string-pieces join, where there are two treenails one inch in diameter. Both under-sill and string-piece are 21 feet long and break joints with the rail (also 21 feet long) and with each other. The section of the rail (d, d) resembles the letter Z, the head or upper table being turned to one side of the stem, and the foot or lower table to the opposite side. The rail is placed against the inner side of the string-piece, with the upper table lapping over the upper and inner edge of the string-piece and thus bearing on the top of the latter, and the lower table resting on the cross-

ties, notched down ¼ of an inch to receive it. A continuous top bearing on the string-piece and detached bottom bearings on the cross-ties are thus obtained. The rail is held against the upright inner side of the string-piece by horizontal screw-bolts (e, e) every 3 feet, which pass through the stem of the rail, about midway between its top and bottom, and through the string-piece; the head of the bolt bearing against the rail, and the nut with a thin washer against an open morticed seat in the outer slope of the string-piece. These bolts (being 9 to each bar of 21 feet) are placed at points midway between the cross-ties, excepting the two in each bar at its end, which come over the cross-ties on which the joints of the rail occur. The rail is further confined laterally, at its foot, by the shoulder of the notch into which it descends, and also held down by a hook-headed spike (f, f) driven vertically into each cross-tie. At each joining of the rails, a cast-iron joint-plate (g, g) is let into the cross-tie to increase the bearing of the rails at these weaker points; this plate having on the outside a ledge to confine the feet of the rails, and two holes in it to permit the spikes lapping over them to be driven downward into the tie. The track thus constructed will rest on a bed of broken stone, sand or gravel ballasting, 10 feet wide at bottom, 8 feet at top and 12 inches deep, which will be filled up to the top of the cross-tie and 1 inch above the bottom of the string-piece and leave a depth of 5½ inches below the under-sill for drainage, etc.

The rail is intended to weigh 45 lbs. per yard; its whole depth is 5 inches; thickness of stem, 9-16 inch; top bearing for the tread of the wheel, 1½ inches; total breadth of upper table, 2½ inches; breadth of bearing of upper table on the string-piece, 1½ inches; breadth of foot, inclusive of stem, 1 9-16 inches; the whole breadth of the upper and lower bearing surfaces, 3 1-16 inches; bolt hole in stem, 1 inch diameter.

The proposed rail, and the structure of which it is a part, will admit, of course, of a variety of proportions. The forms and sizes of the several parts shown in the preceding description and annexed drawing are considered suitable and sufficient for a track intended for the heaviest tonnage and highest speed.* It is hardly necessary to say that the rail and its fastenings, in combination with the string-piece and cross-tie, form the only subjects of claim to invention; as the under-sill, ballasting, attachment by tree-rails, and even the trapezoidal form of the string-piece (for the economy of timber), are none of them new elements of the railway structure.

The estimated cost per mile of a single track of the proposed



railway is as follows; the scale of prices contained in the subjoined note being applied to the several items of material and workmanship:

Ballasting, 1,725 perches of 25 cubic feet at 87½ cts.	\$1,509 37
Under-sills, in 21 feet lengths, 26,400 feet b'd measure	
String-pieces, in 21 feet lengths, 19,800 feet b'd measure	
46,200 feet, at \$35 per M.	1,155 00
Cross-ties, 1,760, at 20 cts. each.	352 00
Treenails, 4,024, at 1 c. each.	40 24
Screw-bolts, nuts and washers, 4,527, w/g ¾ lbs. each = 3,335 lbs., at 12 cts.	407 40
Hook-headed spikes, 4,024, w/g ¾ lbs. each = 1,341 lbs., at 9 cts.	120 69
Joint-plates, 503, w/g 3 lbs. each = 1,509 lbs., at 4½ cts.	67 90
Rails, 70.71 tons, at \$70 per ton.	4,949 70
Workmanship of laying track at \$2 75 per rod.	880 00
Total per mile.	\$9,482 80

No allowance is added for turn-outs, sidings and road-crossings, such as would be proper in an estimate for actual construction, as the extent and cost of these accessories must depend on the circumstances of each case.

The following is a brief enumeration of the particulars in which the undersigned considers his new rail an improvement upon the previous forms of the edge-rail:

1. The lateral support given by the string-pieces to the rail, aided by the lateral strength given to the stem of the latter by the foot or lower web, permits the bar to be made thin and deep without the danger, to which the stem of the T rail is subjected, of buckling or bending sideways, under vertical pressure. Greater strength and stiffness is thus attained in the Z rail, with a given weight of metal, than in the plain T rail—and also than in the H rail or bridge rail; for in both of these latter sections the width necessarily given to the base, for stability of position on its support, prevents the extension of the depth of the bar sufficiently for the attainment of the strongest and stiffest form.
2. The mode of connection between the Z rail and the string-piece makes the latter supply the place of the heavy and expensive chair demanded by the T rail, while the Z rail still enjoys (and in a still greater degree than the T rail) the superior strength and stiffness due to the depth of its section.
3. The same mode of connection gives a continuous support to the upper table, which is not had by any other form of section. And this support not only extends the bearing surface on the wood, but immediately upholds, by an elastic cushion, that part of the head which, in the T and H rails, is so subject to crush, split off and wear away under the wheels; a defect of these sections which will, it is believed, occasion ultimately their entire disuse.
4. The position of the rail on the inside of the string-piece makes the resistance of the rail to the outward lateral thrust of the flanges as great as that of the string-piece itself, a result which cannot be obtained so simply, effectually and economically by any of the modes of fastening the rail on the top of the string-piece, which must be employed with the H or bridge sections. The push of the flange against the rail, it is well known, is the force to be provided against, and this provision is made in the Z rail by the mere effect of its peculiar form: while other rails must be kept laterally in place by auxiliary attachments of iron, the bearing surfaces of which, being individually small, must be multiplied expensively and injuriously to the wood, by wounding it at their points of insertion. The fastenings which attach the Z rail to the string-piece are subjected to little or no strain by the side action of the wheels, and are therefore left to the sole duty of maintaining the contact of the bar with its supporting beam, for the preservation of the joint action of the two in resistance to vertical pressure, and securing the correct line of the road.
5. The attachment of the rail to the string-piece by a number of bolts passing through both efficiently resists the tendency to

* May be dispensed with and ties made heavier and closer.

† This section is given by sawing a timber 5x13 into two pieces, somewhat diagonally.

* Of that day, 1840. † Too low for 1872. ‡ Too high for 1872.



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Editorial Announcements.

Address.—The RAILROAD GAZETTE will be printed for the present in New York; our printing house in Chicago having been destroyed. All communications, therefore, whether editorial or business, should be directed to the New York office. The proprietor will receive subscriptions and advertisements at his office in Chicago, Nos. 63 and 65 South Canal street, but letters should be addressed to New York.

Correspondence.—We cordially invite the co-operation of the railroad public in affording us the material for a thorough and worthy railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Inventions.—No charge is made for publishing descriptions of what we consider important and interesting improvements in railroad machinery, rolling stock, etc.; but when engravings are necessary the inventor must supply them.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

THE DIAMETER OF LOCOMOTIVE DRIVING WHEELS.

If it is required to build a locomotive to draw trains of 500 tons weight up grades of 30 feet per mile, it is a comparatively simple problem to calculate, from the data given in the books, the amount of adhesive weight which will be required on the driving wheels. If we determine their size and the steam pressure to be carried in the boiler, and the rate of expansion in the cylinders, the size of the latter is, at least approximately, deducible by purely theoretical considerations. To determine the size of the driving wheels, however, we must resort to empirical rules alone, or, in other words, we must be governed by experience, observation or prejudice. We will suppose that we have trains of the weight given above, and that we wish to haul them up grades of 30 feet per mile at the rate of 30 miles per hour. By a simple calculation, we can determine that to do so we must have about 18 tons (of 2,240 lbs.) of weight on the driving wheels. When we come to determine their size, however, there are no such absolute rules to govern us. All we know is, that from experience and a sort of common consent, the majority of engineers in this country have agreed that locomotives with wheels about five feet in diameter, and cylinders 16x24 inches, are best adapted to that kind of service; and that boilers with about 50 square feet of heating surface to each ton of weight on the driving wheels consume less fuel than locomotives with relatively a less amount of heating surface.

Engines of these dimensions have ordinarily about 100 cubic inches of cylinder capacity for each inch of the circumference of the driving wheels, and exhaust up the chimney about 11 times in each second when running at the rate of thirty miles per hour. Supposing now that instead of having driving wheels five feet in diameter, we make them only fifty inches, and the cylinders 15x22 inches. On calculation it will be found that we will have about the same number of cubic inches of cylinder capacity to each inch of the circumference of the wheels, with the latter, as we had with the former dimensions. There will be this difference, however: the exhaust

will occur about 13½ times in each second, instead of 11 times, as before. Just the same quantity of steam will be discharged in each case in a given time, but what we want to call especial attention to here is the question whether an engine which exhausts more frequently, but in smaller quantities, will generate more steam than it will when there are fewer exhausts, but a larger volume discharged each time the steam is released. To some it may appear that what is lost in one way is gained in another; but this we think is very doubtful, because the process of combustion, when closely analyzed, is a very delicate one, and what seem to us very minute divisions of time may influence it to a much greater extent than we suppose. Nearly every one has observed, in attempting to kindle a fire by blowing it with his breath, that unless the air is expired as frequently as possible the fire in the intervals is very apt to lose as much as or more than it has gained from our blowing, and that a breath of air which is too violent will put out instead of kindling it. It seems quite probable that the effect of the exhaust in the chimney of a locomotive may have an analogous effect. Every locomotive runner knows that an engine will not make steam rapidly when pulling a heavy train at a slow speed and working at full stroke with nearly the full boiler pressure in the cylinders. The fire will be torn by the violence of the blast, and if not in good condition it requires considerable skill on the part of firemen to avoid what they call "losing their fire."

If such long intervals between each exhaust have this effect, it seems very probable that much shorter ones may have a similar influence, only in a less degree. It must be remembered that there is a difference of nearly 25 per cent. in the number of exhausts of an engine which releases its steam 13½ times per second as compared with one which does so only 11 times. That the influence of this upon the generation of steam may be much greater than at first sight appears seems quite probable.

We are therefore inclined to believe that this subject is worthy of careful investigation, and that in determining the proper size for wheels to do certain kinds of work, locomotive engineers, master mechanics and superintendents would do well to make some accurate and careful experiments. This might easily be done by having two or more sets of cylinders and driving-wheels of different sizes made for a locomotive, with which to test the question. A very little experiment would determine which size of wheels and cylinders generates the most steam under any given circumstances.

There are, however, some other considerations entering into the problem which complicate the question somewhat. It is not only the effect of the multiplication of the impulses of the exhaust upon the fire which must be considered, but there are several other elements which must be taken into account, and whose bearing and relation to the subject should be duly estimated.

All modern practice in steam engineering points strongly to the fact, that high piston speed increases the economy of using steam. There seems, in fact, to be no limit to the speed, except the endurance of the machine itself. Undoubtedly a portion of the economy resulting from high piston speed is the result of using smaller cylinders, and thus exposing the steam to less surface and for a shorter time to radiation of its heat. In locomotive engines, whose cylinders are exposed more than any others, this evil must cause greater waste than when the cylinders, steam chests, etc., can be better protected. When these are small and the speed high, the waste from this cause must be reduced.

There is also another incidental but not unimportant advantage which should be considered. It is an undoubted fact that the larger a locomotive boiler is for doing a given amount of work, the more economically will it generate steam. If, now, the driving-wheels, cylinders, connections, etc., are large, they must be correspondingly heavy, and therefore a larger proportion of the weight of a locomotive will consist of these parts. If the size and weight of these are reduced, a corresponding amount of weight can be added to the boiler, and thus its heating surface, and consequently the economy of its working, be increased.

If, for example, the boiler of an ordinary engine weighs, with water, 25,000 lbs., and the other parts 35,000, then if we reduce the weight of the latter 5,000 lbs., we may make the former 30,000 without increasing the weight of the locomotive. That an increase in the size of the boiler will be attended with greater economy all experience fully indicates.

It is, therefore, a question well worth the attention of all those who use locomotives, whether smaller wheels might not be used with greater advantage. Young engineers and locomotive runners, we know, have often a preference for large driving-wheels; but experience, heavy trains, and a faithful study of the fuel accounts usually modify their first impressions somewhat.

There can, of course, be no doubt that the size of wheels and also the amount of heating surface should be

proportioned to the work to be done. If it can be shown that 50 inches in diameter is the best size for wheels intended to run 30 miles per hour, then obviously they are too small to run 50 miles, and too large for 15 miles per hour. What is most needed now is some data from which can be determined the proper diameter of wheels for any given speed.

The Problem of the Path of the Crank-pin.

When we gave, many weeks ago, a problem for a correspondent and his fellow-workmen to solve, concerning the length of the line described by the crank-pin of a locomotive while the engine runs a mile, we certainly did not intend to puzzle him and them by a question beyond the power of any but skilled mathematicians. Indeed, we gave it with very little reflection, as a question sure to be interesting to men who work on and among locomotives, and likely to give them a little practice in investigation which would not be unprofitable.

We received one solution (from Mr. T. E. Hendricks, of Des Moines) which we published some weeks ago. Meanwhile *The Engineer*, one of the great English engineering journals, copied the problem and received and published several solutions. Some of these we republished a few weeks ago, and these seem to have set our own subscribers at work, for since that time we have received a large number of solutions, most of which we present elsewhere with diagrams in this number of the GAZETTE.

Many of these solutions involve considerable knowledge of and skill in mathematics; but, as will be seen, the problem can be solved simply by arithmetic and the use of a pair of dividers and a rule, and is not at all beyond the reach of the class to which it was addressed.

We will now make a general analysis of the problem.

While the center of the driving-wheel is moving one mile, the crank-pin makes 336 complete revolutions and a fractional part of a revolution—approximately 0.13—, meantime describing what mathematicians call a "prolate or inflected cycloid, or trochoid." This curve does not increase uniformly throughout one revolution. Supposing the generating point—the center of the crank-pin—to start from its lowest position and move through successive equal angular distances, or equal parts of a revolution, then the lengths of those portions of the curve described during such motions will increase till the crank-pin reaches its highest point, then decrease till it returns to the lowest. This will be evident to one who inspects H. S. Maddock's diagram, or who considers the relation of the angular motion of the crank-pin to its linear motion.

Hence, the length of that part of the curve generated during the final fractional part of a revolution will depend upon the position of the crank-pin at the end of the 336 complete revolutions, which is its position at starting. To obtain the minimum curve the crank-pin should pass its lowest position, for the maximum its highest position, when half through this fractional part of a revolution.

It is evident that the curve described may have as many different lengths as the crank-pin may have different positions between the highest and the lowest.

We are now prepared to examine the various solutions which we have received:

"W. L. N.'s" graphical solution is an admirably simple method of approximation. Its accuracy depends, of course, upon the number of parts into which the circle is divided, the scale of construction, and the accuracy of the draughting. With greater care in these respects he would doubtless have obtained a less result, as he assumes the origin that should give nearly the minimum curve.

"Eureka's" solution is simple, but, unfortunately, it is no solution. The crank-pin describes neither the common cycloid nor the right line, the sum of which he assumes as the length of the curve which it does describe.

"A. H. C.'s" general equation is correct for the initial position of the crank-pin which he assumes. From this may be easily deduced a general, differential equation which will give the length of the curve in this special case. We have not verified his result.

"Hindoo's" solution is chiefly remarkable as evidence that he has done no troublesome thinking upon the subject and for its simple freedom from any of Mr. Trautwine's "heaps of mathematical rubbish." Otherwise, it is quite worthless. He conceives of the curve as a common cycloid. If he will "let the light of his inner consciousness play upon" the diagram of "A. H. C.," or that of H. S. Maddock, and if he remembers the form of a common cycloid, he will see his error of conception.

H. S. Maddock's method of approximation is neat and correct. His processes might be simplified. Evidently he made some arithmetical errors in obtaining his result. A somewhat careful, but perhaps not accurate, solution by his method gives 5,489.606 + feet, which is, as it should be, less than either of the results of the analytical solutions.

The equations of the co-ordinates and the differential equations are correct in the analytical solutions of "72 Cornell" and W. L. Marcy. Without carefully following through their processes we should say that probably the difference in their values of s arises from small errors in the work, or from rejecting terms in their series.

The length of the curve is probably between 5,491 and 5,495 feet. The results given by our correspondents are:

W. L. N.	5,504.2
"Eureka"	5,857
A. H. C.	5,502.4
"Hindoo"	6,721
H. S. Maddock	5,567.7
"72 Cornell"	5,495.1
W. L. Marcy	5,491.5
T. E. Hendricks	5,514.4

We have received, too late for publication, or, indeed, anything more than a cursory examination, two other solutions, one by Mr. T. J. Nicholl, which is intended to confirm by a graphi-

cal solution the result attained by Mr. Hendricks; and one by Mr. J. Horrigan, which is all wrong in its methods and its result.

Embezzlements.

The Burlington & Missouri River Railroad Company has recently detected a number of the conductors and station agents in its service in a systematic plot, by which no inconsiderable share of its passenger receipts were embezzled. By collusion between the conductors and agents, the conductors did not punch the tickets sold by these agents, or coupons received from connecting roads, and return them to the general ticket office, but returned them to the agents, who sold them over again, and divided the proceeds with the conductors. The latter are said also to have embezzled a large part of their collections from passengers without tickets. These proceedings are supposed to have been going on some three years, and the company has been engaged in ferreting out the frauds for six months, using almost entirely its own regular employees instead of professional detectives. When everything was traced, as was believed, to the guilty parties, they were arrested all at once. Among those arrested are B. W. Goddell and A. Allison Swearingen, of Burlington, conductors; Howell, McDaniel and Suydam, ticket agents at Red Oak, Corning and Missouri River stations, and, we believe, other conductors. Goddell, it is reported, has property worth from \$40,000 to \$60,000, and had in his possession when arrested \$22,000 in securities and \$600 in cash; but he had been but a short time in the employ of this company, having come to it from the Atlantic & Great Western, and having served on other railroads, which probably have suffered to make up his fortune. Swearingen had been in the company's service about seven years, and was held in high esteem in Burlington, where he lived, but is said to have been living recently in a style hardly befitting a man with an income of \$100 per month.

There is, we are sorry to say, a disposition on the part of the public—at least on the part of many public journals—to disfavor the investigation and prosecution of such cases. For some inexplicable reason stealing by a conductor seems to become, if not excusable, at least not punishable; and in most cases when such offenders are arrested they somehow receive a great deal of sympathy from ordinarily honest men, who would urge the conviction of any other common thief and be indignant at his pardon by the Executive. Perhaps one reason of this is that it is usually difficult to prove guilt beyond question in such cases, and conductors are proverbially popular, and the guilty ones usually most so, being generous (as they can well afford to be) and taking special pains to cultivate the favor of the people who ride in their cars and the "gentlemanly editors" of the newspapers in the towns on the roads, who may become powerful friends in time of need. At least very frequently when a conductor is charged with embezzlement there is a growl at the company all along the line, supported by which (and perhaps by a knowledge of questionable acts by their superiors) the criminals have sometimes defied prosecution and—escaped it.

There is also a very general disposition on the part of the public, and we believe of conductors themselves, to look upon any plan proposed to act as a check and prevent false returns as disgraceful to the company and the employees alike. This is most absurd. There is no other position of trust which does not have checks contrived purposely to prevent fraud, and which affect every official from the ticket agent to the president. They are necessary parts of every business, to which every one submits as a matter of course. Usually, however, these serve other purposes besides the detection of fraud; and the conductor's position is such that they cannot well be applied to him. He therefore feels that the special checks required in his case may appear to indicate that he more than any one else is suspected. This is not true. The special plans are, or should be, adapted to the special circumstances. His opportunities are peculiar, and it is not surprising that he should be subjected to peculiar rules suited to the circumstances. Conductors would be more willing to do this if they knew how much, as a class, they suffer in the public appreciation. Such is their opinion of human nature that men generally believe that of those who have opportunities to retain the money of corporations without detection or the chance of detection, a very large proportion will do so. It is not enough, in such an occupation, to be honest in order to bear the reputation of honesty. Men will continue to suspect those who may be dishonest, if they will, without detection. To remove this general (and generally unjust) suspicion, it is necessary to remove the special opportunities for dishonesty; and conductors, by accepting and encouraging any reasonable system of checks, will really gain in reputation.

THE OMAHA & COUNCIL BLUFFS TRANSFER is not a question of vital interest to the world, or even to the nation, but it is so regarded by the two rivals, which have since their first beginning hated each other with a perfect hatred, not to be understood except by those who have lived in towns divided by a river. The Union Pacific, so long as there was no bridge across the Missouri, necessarily had its terminus in Omaha; and the roads from the east could bring their trains no further than the Iowa bank of the river. But the completion of the bridge enables the Union Pacific to run its trains to and from Council Bluffs, or the Iowa companies to and from Omaha. So far as traffic is concerned, it is a matter of indifference. It remained for the companies to settle the matter among themselves. The Iowa roads, however, do not own the bridge over the Missouri and the Union Pacific does, and the former, therefore, can only reach Omaha by paying rent for a track owned by the latter company. There is not, however, any necessary and insurmountable impediment in this fact. The companies should be, and probably would be, willing to pay a reasonable sum for the use of the bridge in order to get to Omaha if they wanted

to go there. The fact that the establishment of the place of transfer will considerably affect the price of real estate, however, has weight with the companies, to a certain extent, as well as with the towns. They all own some land at the termini, and some of them have considerable tracts.

Now the Union Pacific, in consideration of certain properties transferred to it by Omaha, agrees to have all transfers made in that town, and it was supposed that the question was settled. But the Union Pacific is but one party in determining transfers. It takes at least two railroads to make a connection, but it seems to have been entirely forgotten that the other companies might have something to say on the subject. If anything was to be paid for the establishment of the place of transfer they were just as much entitled to it as was the Union Pacific. At least they did not relish this contract between outside parties, intended to move their termini without their consent across the Missouri and into another State, and they have steadfastly refused to have them so removed. Hereupon there began an extraordinary contest, in many respects disgraceful to both parties, intended to prevent, by legal prohibitions, on the one hand the free transfer of Union Pacific traffic to Iowa, and on the other hand the traffic of the Iowa roads to Nebraska, both of which need to be facilitated, not hindered. Meanwhile the Union Pacific has made an arrangement which ought to satisfy both towns, so far as one can be satisfied without the injury of the other, but is not favorable to the most economical transportation. This is the lease of the bridge and the transfer business to an individual, George W. Homan, Jr., of Omaha, and thus the virtual establishment of a Council Bluffs & Omaha Railroad between the Union Pacific and the Iowa roads. This gives each town a terminus. The Eastern lines, however, are not inclined to consider an individual as a responsible party in the delivery of freights, and there is trouble still.

Very unreasonably, as it seems to us, some newspapers have protested that the Union Pacific should receive nothing more than the ordinary rate per mile for the transportation over the bridge. This bridge alone has cost probably as much as 40 miles of railroad in the Platte Valley, a large share of the traffic over it will never pass over any other part of the Union Pacific's line, and if the interest on its cost, as well as the cost of maintenance and operation, is not paid by the traffic which crosses it (for which alone it exists), the traffic of the entire remaining portion of the road must be taxed to pay it. It is altogether unfair that the traffic which does not use the bridge should be taxed to pay for it.

THE Washington depot question, which brought John W. Garrett and Thomas A. Scott before a committee of Congress recently, is one which the readers of a single newspaper cannot easily understand. It is noticeable that very few journals published the discussion in full, and that in abridging it certain journals gave Mr. Scott's remarks very fully and the merest summary of Mr. Garrett's, and vice versa. From one of these we copied some of the incisive closing remarks of Mr. Scott last week. But in the Baltimore papers it appears that Mr. Garrett did pretty much all the talking and made all the good arguments! He certainly made a plausible case, claiming that the entrance into the city and the grounds granted for a station to the Baltimore & Potomac were so favorable and involved such sacrifices of certain public interests, that it was not to be expected that they would be granted to any other roads, so that they would be in the nature of discriminations in favor of the Baltimore & Potomac and against all other roads. He asked that whatever facilities should be granted to the Baltimore & Potomac might be shared by all other companies entering Washington, and that the new station when established should be made a union depot for all the roads. He urged that the full benefit of competition would not be obtained unless equal advantages are granted to all the roads, and that the Baltimore & Ohio's shorter lines to Pittsburgh, Cincinnati and the West enable it to determine rates, which it can make lower if it has equal advantages in Washington. The fact is, however, that Washington has little good will for Mr. Garrett and his corporation: as is usually the case, the town dependent on a single railroad is strongly prejudiced against it. But there is a general truth in Mr. Garrett's argument; and that it is the policy of towns when they can grant new facilities for transportation to give them in preference to that which already can do the work the cheapest. This route always fixes the rates, in the long run, and a more unfavorable route might only be brought toward an equality by gifts which would make the better route sensibly cheaper.

MR. CHARLES F. HATCH, late General Superintendent of the Lake Shore & Michigan Southern Railway, who entered upon his duties as General Manager of the Eastern Railroad of Massachusetts on the 1st inst., was born near Syracuse, N. Y., about the year 1832. His first railroad service was as rodman on a railroad under construction from Canthawaga, Canada, to the Province line near Moore's, N. Y., now operated as a branch of the Grand Trunk, on which his father had a contract. This was in 1851, and in 1852 he was made Assistant Engineer to succeed Edward H. Williams (now of the Baldwin Locomotive Works and lately General Superintendent of the Pennsylvania Railroad) who had been promoted to be Resident Engineer of the road. From 1853 to 1856 he was a student of civil engineering at Union College, Schenectady, N. Y., under the tuition of the late Professor Gillespie. In June, 1856, Mr. Williams, who was then Superintendent of the Western Division of the Michigan Southern & Northern Indiana Railroad, engaged Mr. Hatch as a clerk; and in this position, nominally, he acted as engineer, train dispatcher, etc. (all for \$50 a month), and made himself thoroughly acquainted with the business of the division, and when Mr. Williams retired from the road in 1858 (Mr. Charles Paine, the late Chief Engineer and present General Superintendent, succeeding him) Mr. Hatch was made Train

Dispatcher of the Eastern Division, and was promoted afterward, successively, to be Superintendent of Branch Roads, Superintendent of Eastern Division, and finally General Superintendent, in which latter position he was continued through all the consolidations, when so many superintendents were to be provided for.

It is evident, therefore, that Mr. Hatch's experience in traffic management has been very large and very varied, his earlier experience making him familiar with the minutest details, and his later with the management of subordinate officials and the consideration of general policies. His appointment on the Eastern Railroad is a decided compliment, not because of the importance of the line—for it is not nearly so important as the line he has left—but because New England has so many skilled railroad managers, and has supplied the West with a large proportion of its ablest ones, and when it goes to the West for an officer is naturally inclined to recall one of these rather than a man strange to its soil.

THE NEW JERSEY LEGISLATURE has vindicated its independence of corporation "influence." Reckless charges had been made that it was the humble servant of the Pennsylvania Railroad Company, recognized as its rightful sovereign by virtue of its succession to the rights, privileges and authority of the United Railroad Companies of New Jersey. More important than all, a list of bills relating to railroads was drawn up and printed, in which those that the railroad company had marked for passage and those it had ordered to be defeated (according to these vile slanderers) were designated, and it was charged that the Legislature would faithfully pass the former and defeat the latter, in accordance with their (so the libel ran) contract with the railroad company. What rendered this list particularly provoking was the fact that the bills marked as approved by the railroad company were just those wise and important measures which no legislator faithful to the best interests of the State could fail to vote for; while those marked as disapproved by the company were the illiberal, harmful bills which members faithful to their constituents must inevitably vote against. Now what could virtuous legislators, independent and careful of their reputations, do to vindicate their characters? If they should pass the laws as marked on the libelous list they would be charged with serving a corporation rather than the people; if they should fail to pass them they would bring disaster upon their State. But genius such as only a New Jersey Legislature could display saved at once their reputations and their consciences. The lower house took up the bill most obnoxious to the Pennsylvania Railroad Company, one chartering a road of standard gauge from Jersey City to Camden, and boldly and defiantly passed it by a very small majority. Thus was its independence vindicated. Then the upper house took the bill in hand and defeated it, thus averting a public calamity. Now if the Senate will pass one of these obnoxious bills for the Assembly to defeat, the purity, independence and public spirit of the New Jersey Legislature will be demonstrated beyond all cavil.

THE "NEAT PROBLEM" which we gave nearly three months ago, concerning the length of the line described by the crank-pin of a locomotive, and which for a long time received little attention in this country, has lately brought us an avalanche of solutions, which we give on another page.

We propounded the problem originally to men in railroad shops, and we fear that many of these, on seeing the display of algebraic symbols and the use made of the calculus in some of these solutions, may think that it was almost an imposition for us to ask them to solve it. We did not intend to restrict the consideration of the problem to those who are skilled in the higher mathematics; and one of the solutions—that by "W. L. N." of Cleveland, shows that it may be solved without either calculus or algebra. This solution is entirely graphical: that is, the author has drawn the line which the crank-pin describes on a small scale, measured the length of it for one revolution of the driving-wheel, and thus obtained a basis for the measurement of the line for a mile of track.

Most locomotive runners and men in shops will, we think, be able to understand this solution and follow its steps.

It is worthy of notice that this solution is by a locomotive runner who was laid up for some time by an accident which sent him "down the bank" with his engine and train, and laid him up for repairs somewhat battered. But though his body was disabled his mind seems to have been active enough, and this specimen of its work, creditable to any one at any time, is especially creditable under the circumstances.

THE GENERAL TICKET AGENTS' ASSOCIATION, which held its annual meeting in Louisville on the 26th ult., was attended by the representatives of sixty-six different railroads. The officers chosen for the ensuing year are E. A. Ford, of the Atlantic & Pacific and Missouri Pacific roads, President; S. E. Carey, of the New Orleans, Jackson & Great Northern, Vice-President; Samuel Powell, of the Chicago, Burlington & Quincy, Secretary; S. F. Pierson, of the Cleveland, Columbus, Cincinnati & Indianapolis, W. P. Johnson, of the Illinois Central, W. L. Danley, of the Nashville & Chattanooga, Executive Committee.

The half-yearly meeting will be held in New York September 25.

MUNICIPAL AID to railroads is prohibited by the new constitution of Illinois; but just before this constitution went into force, votes of aid were made liberally, not to say recklessly, in almost every county of the State, and in many instances to companies now dead and past all hope of resurrection. Now in order to secure these subscriptions to newer or at least more promising companies, a bill has been introduced into the Legislature to provide for the transfer of any subscriptions made before the adoption of the constitution to any company which may comply with the terms of the original subscription. This is a measure of very doubtful legality, but it has passed the lower house.

Train Accidents in March.

On the morning of the 1st the boiler of locomotive No. 14 of the Delaware, Lackawanna & Western Railway exploded while drawing a train of coal cars through the Luzerne cut, a mile and a half from the depot in Scranton, Pa. The locomotive was blown into fragments. The fireman and a brakeman were badly injured. The engineer was unhurt.

On the 1st, the boiler of the locomotive "Falls Village," while standing on a side track of the Connecticut Western Railroad at Winsted, exploded. Three men were in the cab, but no one was seriously hurt. It is reported that the engine was "old and worn out."

On the afternoon of the 2d, near Middletown, on the Erie Railway, one freight train ran into the rear of another, and the caboose and a car loaded with flour on the forward train caught fire and were burned.

On the morning of the 4th, a freight train on the Lake Shore & Michigan Southern Railway was thrown from the track by a broken rail near Clyde, Ohio. Twenty cars are reported to have been wrecked, and a section-man who happened to be standing by the track at the time was killed.

On the afternoon of the 5th, the engine of a freight train on the Chicago, Burlington & Quincy Railroad ran off a bridge, the rails having been removed for repairs. The engineer and fireman saved themselves by jumping, but the Division Superintendent, Mr. L. Carper, was killed.

On the 5th, an express train going west on the Pittsburgh, Fort Wayne & Chicago Railway, was thrown from the track near New Galilee, O., completely wrecking four coaches and injuring two passengers severely and a few others slightly. A broken rail was the cause.

On the 5th, a broken rail near Lexington, O., on the Lake Erie Division of the Baltimore & Ohio Railroad, threw a freight train from the track, breaking up eight cars, but injuring no person. The whole train except the engine and the caboose left the track.

On the 5th inst., an express train going north on the Cleveland, Columbus, Cincinnati & Indianapolis Railroad, while running about 35 miles an hour, was thrown from the track by a broken rail. Everything left the track except one end of the sleeping car at the tail of the train, and the engine, baggage, express and two passenger cars were badly wrecked. Strange to say the only persons injured were the engineer and conductor, who were severely but not dangerously bruised.

An Ohio correspondent calls attention to the fact that on the night of the 4th the weather changed from mild to severe cold, and the next day in northwestern Ohio there were four accidents from broken rails.

On the morning on the 7th, engine No. 715, of the New York Central special train for New York, broke its connecting-rod pin, two miles distant from Buffalo, lifting the engine off the track and breaking a rail. Three of the passenger cars were thrown from the track, and one caught fire, but was soon extinguished with snow. Twelve or fourteen passengers were injured, most of them slightly and none fatally.

On the 7th, a freight train going north on the main line of the Illinois Central broke a rail about a mile and a half north of Hudson, and the tender, two cars loaded with hay and eight empty stock cars were thrown into the ditch. The fireman was somewhat injured.

On the morning of the 8th, the night passenger train from Boston to New York was thrown from the track of the Hartford & New Haven Railroad, about two miles below the Springfield depot, by a broken rail. It was running around a curve at the rate of about 15 miles an hour. The engine and express-car passed over the break without injury. The baggage, mail and one passenger car went down an embankment, two of them upon the ice in the Connecticut River. Three sleeping cars in the rear left the rails but remained on the embankment. Fifteen passengers were injured, some severely, but none fatally. The mail car took fire and was destroyed.

On the morning of the 8th, the boiler of a locomotive drawing a freight train on the Vicksburg & Meridian Railroad exploded, at Edward's depot. No one was injured.

On the morning of the 8th, an eastward-bound freight train on the Toledo, Wabash & Western Railway ran off the track at Norrie, Ill., 11 miles west of Tolono, badly damaging the engine and several cars and slightly injuring a brakeman. No cause is assigned.

On the night of the 9th, a coal train going north collided with an ore train going south on the Cleveland & Mahoning line of the Atlantic & Great Western Railroad between Niles and Girard. Both engines and several cars were much damaged, but no one was hurt. The conductor of the coal train had been ordered by telegraph at Girard to wait there for "No. 36 and extra to pass." He waited for No. 36, but not for the extra, which he ran into.

On the morning of the 14th, a car of a passenger train on the Cincinnati, Hamilton & Dayton Railroad got off the track and upon the track of the Marietta & Cincinnati Railroad, a few miles from Cincinnati, where the tracks of the two roads are close alongside. Red lights were shown, but not in time to prevent a Marietta train running into the car at a moderate speed. One passenger was injured.

On the 15th, the telegraph reports that the ladies' car of a train going north on the Lake Superior & Mississippi Railroad was "thrown from the track" and down an embankment. A lady was fatally injured and several passengers were slightly hurt. No cause is assigned.

On the morning of the 16th, the smoking car of a suburban train on the Eastern Railroad was thrown from the track and overturned at Somerville, Mass. The cause is not explained. No one was hurt.

The overturned smoking car obstructed both tracks, and an inward-bound train, while attempting to cross on a side track, was thrown from the track by it. The chief damage was the delay of trains for an hour and a half.

On the morning of the 16th, a rail broke under a passenger train on the Boston & Albany Railroad, about a mile and a half east of Wilbraham. The engine, tender and baggage car passed over safely, the smoking-car went off the track and down the embankment, and the other cars left the track, but remained on the embankment. The conductor and a brakeman, who were in the smoking-car, were severely hurt, and 11 passengers less seriously and one probably fatally. It is reported that the rail had been in the track 12 years and had marks of an old flaw.

On the 21st, a snow train on the Western Division of the St. Paul & Pacific Railroad when retiring from work for the night had two engines in front, two caboose cars and a box car containing the workmen following, and an engine with the snow-plow in the rear. While on the road, in a great storm of blinding snow, the rear engine became detached, unknown to those in the cars and on the forward engines; and this engine ran into the cars while stopping at a station, killing the conductor and a brakeman, wounding terribly the assistant roadmaster, and injuring others.

On the morning of the 21st, the express train on the Pittsburgh, Fort Wayne & Chicago Railway due at Fort Wayne at 3 a. m. was thrown from the track by a broken rail about five miles west of Fort Wayne. The express messenger was seriously, and several passengers slightly injured. Two baggage, one express, two day passenger cars and one sleeping car were burned.

On the 22d inst., at 7 a. m., the Southern express train on the Pennsylvania Railroad encountered a broken rail at Conemaugh Furnace, 75 miles east of Pittsburgh. The engine and six cars nearest it kept the track, but three sleeping cars at the rear were thrown from the track, and one went down the embankment. Two persons were killed and thirteen injured, two seriously and others severely.

On the morning of the 23d the boiler of a passenger locomotive on the Michigan Central Railroad exploded shortly after starting in Chicago. Only the forward sheet gave way, but this was blown into several pieces, which were scattered over an area of several hundred yards, and one went through the roof of a house. Strange to say, no one was hurt.

On the 23d, as a number of trains were passing through Sand Patch Tunnel, on the Pittsburgh & Conneville Railroad, a coupling broke on the foremost train, and three cars were broken off at the rear of the train, which the following train ran into and broke to pieces. One of these was loaded with carbon oil, which took fire. The following train was barely saved by backing out of the tunnel, and the timber work, with which it seems that the tunnel was lined, was burned, and part of the roof fell in. A flagman is reported seriously if not fatally hurt.

On the 25th, locomotive No. 143, of the Baltimore & Ohio Railroad, exploded at Bowlesburg, W. Va., just after leaving the depot, killing the engineer and fireman and blowing the boiler and upper works of the engine to atoms.

On the 26th, a freight train on the Pittsburgh, Fort Wayne & Chicago Railway, at the crossing of the Rock Island road, a few miles south of Chicago, ran into a freight train of the last named road. The Fort Wayne engine and two cars of the Rock Island train were badly damaged. It is reported that one or both of the trains neglected to come at a full stop at the crossing, as the rules of the roads and the laws of the State require.

On the 27th, near Battle Ground, Ind., on the Louisville, New Albany & Chicago Railroad, a passenger car in the middle of a train was thrown from the track by a broken rail, and finally went down the bank. No one was hurt.

The month has been distinguished by the number of accidents from broken rails and from boiler explosions. Many of the former were early in the month, when the weather was extremely cold. The causes may be tabulated as follows:

Broken rail.....	10
Explosions.....	5
Collisions.....	5
Derailment from unassigned causes.....	4
Rails removed for repairs.....	1
Breaking of connecting rod.....	1

There were two rear collisions, one head collision, and one crossing collision.

In the case of nine of these accidents no one is reported as hurt. By the seventeen others nine were killed and 67 injured, besides those included in the reports which say "some" or "several" were slightly injured. Our report for February included 21 accidents, by which 18 persons were killed and 138 injured.

We have given above a statement of all the train accidents of which we have information. Probably it covers most of those which caused death or serious injury; there were in all probability many whose results were not serious, of which we have no trace.

New Orleans, Mobile & Texas.

G. W. R. Bayley, Chief Engineer, makes the following statement:

"A thousand men or more will soon be at work on different parts of the road. A large force will commence work at Vermilionville, and will work west toward the Sabine. A large force is about repairing to Lake Charles, near the sulphur mines. Another force will commence work at Berwick's Bay. As the road is already graded from Berwick to Vermilionville, a distance of about 60 miles, gangs will be at work all along this line repairing the road, building culverts and bridges, and preparing the road-bed for cross-ties and iron. The whole work of connecting Berwick's Bay and the Sabine by the iron link is to be completed by March, 1873. The old Texas Railroad, extending from Houston to Beaumont, about 25 miles from Orange, on the Sabine, has been purchased by the same company now building the road from Berwick's Bay to the Sabine, at \$1,000,000. It is understood that this road is to be worked over and improved while the work on this end of the road is progressing, and that when the Louisiana end shall be in good running order, in March, 1873, cars from New Orleans may cross the Sabine, and proceed on a good road to Houston."

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—Mr. Jay Gould having resigned his position as a director of the Erie Railway Company, on the 26th ult., the board chose in his place Mr. Edward H. Green, of the London & San Francisco Bank, now in London, a wealthy retired merchant formerly in the Manila trade in New York, and of the well-known firm of Russell, Sturgis & Co. Mr. Green is one of the committee of five appointed in London to represent the "English shareholders"—that is, the Bischoffsheim & Goldschmidt party. He evidently has been privy to the proceedings which were to be instituted for the change of management, as he is reported to have purchased 50,000 shares just before the *coup d'état*, on which, if he had sold at the proper time, he would have made \$1,500,000 or more. If he has them still and intends to keep them, he is likely to be a good director. On the 27th, Mr. Drake retired from the directory and William Wetmore Cryder, of the old China firm of Wetmore & Cryder, was chosen to succeed him. Mr. Cryder is also one of the committee.

—At a recent meeting of the Castine & Ellsworth Railroad Company of Maine, the charter recently granted by the Legislature was accepted, and Capt. Charles Deering, of Portland; Munroe Young, of Ellsworth; Luther G. Philbrook, Alfred F. Adams and Samuel T. Noyes, of Castine, were chosen directors for the ensuing year. Capt. Charles Deering was chosen President, and Gen. Charles W. Tilden, of Castine, Treasurer.

—Lucien W. Palmer, freight agent at Providence of the Providence & Worcester Railroad, has been appointed Superintendent of the Connecticut & Passumpsic Rivers Railroad, and entered upon the duties of that position on the 1st inst.

—At the annual meeting of the Petersburg Railroad Company, held in Petersburg, Va., on the 21st ult., the following directors were elected for the ensuing year: Messrs. T. T. Brooks, S. A. Plummer, William R. Mallory, J. Campbell Maben and R. A. Young. Messrs. Brooks and Plummer were in the old directory. Reuben Ragland was chosen President.

—Mr. Isaac Drippes, Superintendent of Machinery of the Pennsylvania Railroad, has resigned, and Mr. G. Clinton Gardiner, who has been Mr. Drippes' assistant for some time, is appointed to succeed him.

—C. G. Mack has been appointed Assistant Superintendent of the Indianapolis & St. Louis Railroad.

—Charles Chappel has been appointed Assistant Superintendent of the Chicago, Burlington & Quincy Railroad, in charge of the Burlington Division, to succeed Mr. Carper, who was killed recently. Mr. Chappel has been in the service of the company many years, and was for a time a Division Superintendent on the Union Pacific. He has a reputation for remarkable skill in the operation of a road.

—Mr. L. H. Sellars, long Master Mechanic of the Huntsville shops of the Memphis & Charleston Railroad, has accepted an appointment as Assistant Superintendent of the New Orleans, Jackson & Great Northern Railroad.

—Official announcement has been made of the appointment of John C. Gault as Assistant General Manager of the Milwaukee & St. Paul Railway. Mr. Gault's qualifications for this position could hardly be greater except by service in it for some time; and this not merely because of his general ability and knowledge of traffic management generally, but because of his peculiar knowledge of the field in which the Milwaukee Company's lines run. When this company has completed its line to Chicago, it will be very similar, in the nature and direction of its traffic, to the Northwestern, which latter Mr. Gault has operated successfully and knows probably quite as intimately as any other man—at least so far as regards the sources of its traffic and the best methods of accommodating it. The Milwaukee & St. Paul has, we think, been very fortunate.

—S. E. Carey, General Ticket Agent of the New Orleans, Jackson & Great Northern Railroad, has been appointed to the same position on the Mississippi Central also, superseding Mr. D. B. Morey, who is made General Freight Agent of the two roads.

—Charles L. Fitch has resigned the position of General Freight and Ticket Agent of the Mobile & Ohio Railroad, and accepted a similar position on the New Orleans, Mobile & Texas.

—John A. Punch has been appointed General Freight and Ticket Agent of the Mobile & Ohio Railroad in place of C. L. Fitch, resigned. Mr. Punch has been in the company's service for many years.

—Mr. James B. Hodgskin has been appointed Assistant Treasurer of the Erie Railway Company, and the auditing department, heretofore independent, has been put under his charge as a branch of the treasury department. Mr. Hodgskin is Treasurer and one of the directors of the Atlantic & Great Western Company.

—The following were chosen directors of the Second Avenue Railroad Company of New York on the 1st inst.: Thomas Crane, Edward Haight, John Slosson, Julius Wadsworth, Le Grand Lockwood, Jr.; George Bell, H. C. Beach, Augustus E. Masters, John J. Donaldson, Solomon Mehrbach, William S. Thorn, Frederick De Billier, James D. Fish.

—At the annual meeting of the Panama Railroad Company, held in New York on the 1st inst., of the 70,000 shares of capital stock, 66,500 were voted upon, of which 35,794 were for the following gentlemen: William H. Aspinwall, David Hoadley, Francis Skiddy, H. H. Baxter, Henry Clews, J. D. Smith, Alexander Masterton, Fred. Billings, F. W. G. Bellows, L. S. Stockwell, G. L. Kingsland, J. Farnley. This board has but two members of the old board—Messrs. Aspinwall and Hoadley—and most of the members are also members of the Pacific Mail Steamship Company, which will now control the road. On the 2d the new directors chose A.

B. Stockwell President and F. W. G. Bellows Vice-President.

—At the annual meeting of the Pacific Railroad Company of Missouri, held in St. Louis on the 25th March, 27,732 shares of the 36,000 were voted, and the following were chosen directors: Joseph Seligman, New York, vice E. O. Stanard; Francis B. Hayes, Boston, vice R. J. Lackland; Charles J. Morrill, Boston, vice Oliver A. Hart; T. B. Edgar, St. Louis, re-elected; John J. Tausig, St. Louis, vice Benjamin Stickney; Seligman, Hayes and Morrill are directors of the Atlantic & Pacific. The present board stands as follows: Hudson E. Bridge, B. W. Chambers, N. C. Chapman, W. H. Coffin, T. B. Edgar, F. B. Hayes, George E. Leighton, Charles J. Morrill, Andrew Pierce, Jr., C. Ranken, Jr., Joseph Seligman and J. J. Tausig. Hon. Joseph Brown was unanimously re-elected President; John C. Porter, Secretary and Treasurer.

—At the annual meeting of the New York & Oswego Midland Railroad Company, held in Oswego, N. Y., March 27, the following were chosen directors for the ensuing year: D. C. Littlejohn, Cheney Ames, William Foster, D. W. C. Stephens, J. W. Merchant, E. T. Hayes, John A. Randall, John R. Clarke, Henry E. Bartlett, A. C. Edgerton, Edward Palen, Elisha P. Wheeler, Henry R. Low.

—At the annual meeting of the Quincy, Missouri & Pacific Railroad Company, held in Quincy, Ill., March 5, the old officers and directors were re-elected. They are: John Wood, Caleb M. Pomroy, Thomas Jasper, Charles H. Bull, Thomas Redmond, George Adams, Henry Root, Charles A. Savage, Quincy; N. G. Rosenberry, Maryville, Mo.; J. W. Blackburn, Rockport, Mo.; J. N. De France, Kirkville, Mo.; Philip B. Linville, Edina, Mo.; A. P. Cogswell, Brownville, Mo. Charles A. Savage, President; Joseph W. Blackburn, Vice-President; Charles H. Bull, Treasurer; George S. King, Secretary; John H. Schermerhorn, Chief Engineer and General Superintendent.

—C. C. Spring having resigned his position as New England Agent of the Lake Shore & Michigan Southern Railway, W. W. Ruggles has been appointed General Traveling Agent for Massachusetts and Northern New England; W. A. Cromwell General Traveling Agent for Eastern New England and the Provinces, with headquarters at the Old State House, Boston, while James S. Smith will represent the company in Boston.

TRAFFIC AND EARNINGS.

—The receipts of the Lake Shore & Michigan Southern Railway for the third week of March were: 1872, \$326,000; 1871, \$279,000; increase, \$47,000, or 17 per cent.

—The receipts of the Grand Trunk Railway of Canada for the week ending March 9 were: 1872, \$31,900; 1871, \$31,600; increase, \$300, or about 1 per cent.

—The receipts of the Great Western Railway of Canada for the week ending March 9 were: 1872, \$20,361; 1871, \$19,146; increase \$1,215, or 6½ per cent.

—The earnings of the Kansas Pacific Railway for the third week of March were \$70,865.61, \$42,777.47 being from freight.

—The earnings of the St. Louis & Iron Mountain Railroad for the third week of March were: 1872, \$42,562; 1871, \$32,776.38; increase, \$9,785.62, or 30 per cent.

OLD AND NEW ROADS.

Eastward Freight Rates.

By the tariff taking effect March 25, the rates from Chicago are:

	First Class.	Second Class.	Third Class.	Fourth Class.	Fifth Class.	Sixth Class.	Seventh Class.	Eighth Class.	Ninth Class.	Tenth Class.	Eleventh Class.	Twelfth Class.	Thirteenth Class.	Fourteenth Class.	Fifteenth Class.	Sixteenth Class.	Seventeenth Class.	Eighteenth Class.	Nineteenth Class.	Twentieth Class.
New York.....	1.60	1.25	.85	.60	1.20	.80	.90	.70	.60	1.60										
Boston.....	1.70	1.35	.90	.65	1.30	.85	1.00	.75	.65	1.70										

The rate on grain is at the rate of 36 cents a bushel for wheat and 33 3-5 cents for corn to New York.

Cunard & Red Line Express.

This is the title of a transportation company organized and operated by the Cunard Steamship Company and the Red Line Transit Company, for the purpose of conveying merchandise in bond from Liverpool and other British and European points to all interior ports of entry in America reached by Red Line cars—that is, to those on the New York Central & Hudson River, the Boston & Albany, the Lake Shore & Michigan Southern, the Toledo, Wabash & Western and the Chicago, Rock Island & Pacific railroads, thus reaching as far west as Chicago, St. Louis, Leavenworth and Omaha. The company receives consignments in Europe and transports them through to interior points where there are bonded warehouses without further care from consignor or consignee. It has in Chicago the use of a new fire-proof bonded warehouse, recently completed by the Lake Shore & Michigan Southern Company. During the past season it has carried from Chicago to Liverpool 25,547 tons of freight, chiefly grain and provisions. J. Macdonald, Chicago, is the General Western Agent.

Northern Pacific.

Fargo, where the Northern Pacific crosses the Red River of the North, is 242 miles west of the junction with the Lake Superior & Mississippi Railroad and only four miles south of the latitude of that place. It is 18 miles south of Georgetown and 32 miles north of Fort Abercrombie. The prairie land of the Red River valley extends about 40 miles west of it, and for 60 miles it is reported that the located route of the railroad is a single

tangent. Between the James and the Missouri there is a range of somewhat difficult hills, through which, however, it is reported that a route has been found with grades no more than 48 feet to the mile. East of the Missouri is a rolling prairie entirely without trees. The descent to that stream is by the valley of Apple Creek, which empties nearly opposite the mouth of Heart River, up which it is expected that the route will be fixed from the Missouri westward.

South American Railroads.

Recent mails bring the following news: The Rimac & Oregu Railroad has suffered badly from rain and floods. Henry Meiggs and the Baron de Riviere are said to have taken a contract to build a railroad from Caracoles to Mejillones. Sixteen miles of the Pacasmayo, Guadalupe & Magdalena Railroad have been laid, and the telegraph completed to Pacasmayo.

In the Argentine Republic, the Pass of La Patos, over the Andes, is to be surveyed and the Rosario & Cordova Railroad extended.

Mobile & Alabama Grand Trunk.

The track of this road is laid from Mobile northward to a point a little above Mount Vernon, Washington County, a distance of 34 miles. It is generally from two to four miles west of the Tombigbee River. Work is progressing on the extension northward.

Petersburg Railroad.

At the annual meeting of this company in Petersburg, Va., on the 20th ult., resolutions were adopted looking to the extension of the road to City Point.

New York, West Shore & Chicago.

This company has purchased the "Elysian Fields," at Hoboken, with 1,000 feet front on the Hudson. The route thence is to be along the west bank of the Hudson as far north as Athens, where it is to turn westward. The company has purchased the New York & Fort Lee Railroad as a part of its line.

Lehigh Valley.

This company asks bids for excavating a tunnel a mile long through the Musconetcong Mountain, about eleven miles from Phillipsburg, New Jersey, and also for several heavy sections of grading between the tunnel and Phillipsburg, to be completed by April 1, 1874. Profiles, plans and specifications may be seen at the Lehigh Valley Company's office, Bethlehem, Pa., where proposals should be directed.

Delaware, Lackawanna & Western.

This company has declared a quarterly dividend of 2½ per cent., payable April 20. The transfer books were closed March 30.

Hannibal & St. Joseph.

This company proposes to the city of St. Joseph that it will remove its main construction and repair shops from Hannibal to St. Joseph, complete the St. Joseph bridge across the Missouri, and complete the St. Joseph & Topeka Railroad (Doniphan to Atchison), if the city will give it its \$500,000 stock (a controlling interest) in the St. Joseph bridge, and exempt all its property from city taxation for eighteen years.

Central Pacific.

The following petition in relation to the granting by Congress of the use of Yerba Buena Island, in San Francisco Bay, for terminal stations of the Central Pacific Railroad has been forwarded to Washington signed by 24,420 citizens of San Francisco, which indicates pretty clearly that the scheme is very unpopular there:

"The undersigned, citizens of San Francisco, being impressed with the importance of protecting and preserving the usefulness of the bay and harbor of San Francisco for the purpose of commerce and navigation, respectfully represent that:

"Whereas, Several enterprises are projected, such as the conversion of Yerba Buena Island into a railroad depot and the construction of a bridge from the Contra Costa shore to that island, which would involve serious impediments in the way of free navigation in the aforesaid bay and harbor, and obstructions in the ship channel which will interfere with the tidal current; and

"Whereas, Officers of the United States Corps of Engineers have made known that the military occupation of Yerba Buena Island is necessary to the protection of the city; therefore, they do earnestly pray that Congressional sanction may be withheld from any enterprise looking to the conversion of Yerba Buena Island into a railroad depot or terminal. And, also, from all other enterprises which threaten to jeopardize our safety and protection, or to impair the usefulness of the bay and harbor of San Francisco. And your petitioners will ever pray."

Panama Railroad.

This company announces a dividend of 5 per cent., payable April 8 and afterward. This is the company's 55th dividend.

Stonington Railroad.

This company announces a quarterly dividend of 2½ per cent., payable April 10.

Indiana & Illinois Central.

This is an old company, which had considerable work done on its line (between Indianapolis and Decatur, Ill.) years ago. Within a short time it has been thoroughly reorganized, and it now is in the hands of strong capitalists, who have the means and are prepared to complete the road. The present directors are: H. B. Hammond, New York, President; Henry Lewis, Philadelphia, Vice-President; Sidney Dillon, New York; Wm. H. Guion (of Williams & Guion), New York; John L. King, Springfield, Mass.; George M. Pullman, Chicago; Benj. E. Bates, Boston; T. W. Pierce, Boston; A. H. Lazare, New York; A. L. Roache, Indianapolis; E. M. Benson, Montezuma, Ind.; Thomas H. Macoughtry, Tuscola, Ill.; John K. Warren, Decatur. The five last named were in the old company, the others are new men in the directory, and many of them are well known, responsible capitalists, with a reputation for carrying out what they undertake.

We are authoritatively informed that the new board has secured from American and foreign capitalists subscriptions and pledges sufficient for the completion of the entire line of 181 miles.

The work done some years ago (at an aggregate cost of \$530,000) was equivalent to the grading of about 35 miles of the line. Last year bridge piers were constructed, and new contracts have been let for the completion of the road-bed from Decatur to Rockville, Ind., nearly 100 miles, and for the ties for the entire line. Grading is in progress in Douglas County, Ill., and the iron for the section through this county, nearly 30 miles, is purchased. The officers say that the entire line will be completed within eighteen months. The line passes through the celebrated "block coal" field of Indiana about 18 miles north of Brazil, and a large traffic in that fuel is anticipated. The new rolling mill in Decatur alone will use a large amount, and there is a prospect that other iron-working establishments of importance will be established at points on the line.

Leavenworth Bridge.

The first train crossed this bridge Easter Sunday, March 31, and the test is reported to have been highly satisfactory. A celebration of the completion of the bridge is to be held in Leavenworth on the 11th.

Cincinnati, Lafayette & Chicago.

Heretofore there have been two companies of this name, one owning the line in Illinois, the other that in Indiana. The two were consolidated under the common name last week. The Indiana officers and directors hold their places in the consolidated company.

Baltimore & Potomac.

The bill for the location of this company's depot in Washington, on Sixth street, between Pennsylvania avenue and the canal, passed the House on the 1st, after a most determined opposition on the part of the minority (which was less than one-third), which had delayed business for some days.

Great Western of Canada.

The directors announce that at the half-yearly general meeting of shareholders, to be held April 17, an agreement for the purchase of the Erie & Niagara Railway will be presented for ratification or rejection. The transfer books were closed at the Canada office on the 3d inst.

Pennsylvania Railroad.

Baltimore papers say that this company will probably construct a branch road from its main line at Penningtonville (47 miles west of Philadelphia) southwest, crossing the Susquehanna at Peach Bottom, to a junction with the Northern Central Railway at Monkton, 23 miles north of Baltimore. This, it is said, would form a route from Baltimore to Philadelphia entirely controlled by the Pennsylvania Company, and only about fifteen miles longer than the present route, and for through business more favorable, as it would enable trains to be taken around Philadelphia instead of through it. The road to be constructed would be about 60 miles long. As the Pennsylvania will now have as allies some thousands of miles of railroad in the South converging at Baltimore, an independent short outlet from that city to Philadelphia, and thus to New York, is certainly desirable.

Atchison, Topeka & Santa Fe.

This company has let the contract for the construction of a line from Atchison to Parnell Junction, six miles. Hitherto it has used the track of the Central Branch Union Pacific as an Atchison entrance.

Pullman Cars from New York and Philadelphia.

The Pullman Car Company have established an office at No. 287 Broadway, New York, for the transaction of their eastern and local business. Mr. George M. Gray, of Chicago, has been appointed their general agent for that office.

This company are now moving "drawing-room cars" between New York and Philadelphia on the trains which leave New York at 9:30 a. m., 12:40 and 5 p. m., and on the trains which leave Philadelphia at 11 a. m. and 5:30 p. m. The charge for seats in these cars from New York to Philadelphia is 50 cents.

Erie Railroad.

A report finds general acceptance that Daniel Drew has sold to Duncan, Sherman & Co., to deliver at any time within a year, 50,000 Erie shares at 55. This price is about \$1,000,000 more than the shares would bring before Gould's retirement.

The highest price reached by the stock in the New York Stock Exchange was on Tuesday the 26th ult., when 3,400 shares were sold at 67½, and an immense number at lower prices. At this price the common stock would amount to more than \$52,000,000, which is by itself more than enough the build and equip two railroads from New York to Buffalo.

European & North American.

During the late storm 40 miles of this road had to be cleared of ice with the pickaxe, and there were drifts 12 feet high. Trains were delayed for five days.

Utah Northern.

The first rail on this railroad was laid on the 25th ult.

Jacksonville, Pensacola & Mobile.

On the 20th inst., this, the chief railroad of Florida, went into the hands of Hon. J. C. Greeley as Receiver.

Louisville & New York.

Cars now run through between Louisville and New York by way of the Louisville, Cincinnati & Lexington Railroad, and the new bridge at Cincinnati. The first left Louisville Sunday last.

Alabama & Chattanooga.

John H. Gindrat, Samuel B. Jones and John F. Bailey, assignees in bankruptcy of this company, advertise that they will sell the entire road, from its terminus at Meridian, Miss., to its terminus at Wauhatchie, Tenn., with equipment and all other property, including station buildings, shops and machinery in Chattanooga, at Montgomery, Ala., on the 22d instant, subject to the lien of

the State of Alabama on its indorsements of the company's first mortgage bonds, to the amount of \$4,720,000, and to the lien of the holders of those bonds, and to the lien of Alabama for \$32,586 of interest paid on those bonds; the part in Georgia will also be subject to the lien of that State, unless it shall be settled before the time of the sale, as is possible.

Lake Shore & Michigan Southern.

The annual meeting of this company will be held in Cleveland on the 1st of May. The transfer books were closed March 30, and will be reopened May 2.

Springfield & Illinois Southeastern.

On the 28th ult. trains commenced running regularly over the entire length of this road from Beardstown southeast to Shawneetown, 225 miles.

Report of the Illinois Central Railroad Company.

The lines owned by the Illinois Central Railroad Company are what is known as the "Main Line," from Cairo to Dunleith, Ill., 455½ miles, and the "Chicago Branch," from Centralia (112 miles north of Cairo) to Chicago, 249½ miles—a total of 705½ miles of main line, of which the section from Chicago to Calumet, 14½ miles, has a double track. It operates under a long lease the Dubuque & Sioux City and the Iowa Falls & Sioux City railroads, together forming a line from Dubuque west to Sioux City, Iowa, 326½ miles long, and the Cedar Falls & Minnesota Railroad, a branch of the last-named line from Cedar Falls (98 miles west of Dubuque) north by west to the Minnesota line, 75½ miles. It also operates the track of the Dunleith & Dubuque Bridge Company, which unites its Iowa and its Illinois lines, and is about 1½ miles long. The total length of road leased is thus 403½ miles, and the length of road operated 1,109 miles.

The following is the report of the President for the year 1871: Illinois produced in 1870 and 1871 large harvests of corn, and fair crops of other cereals, which afforded a large freight traffic in Illinois the past year, and covered the decrease in earnings from business of the Iowa leased lines, caused by the partial failure of the crops in that State in 1870-71, up to the date of the Chicago fire, in October last.

The loss of traffic consequent upon the destruction of the business portion of the city by fire has been large. Fortunately a demand from the Gulf States for the products of the Northwest made a heavy freight traffic south over the road in November and December.

The earnings of the line in Illinois were.....	\$7,052,440 46
The working expenses.....	\$3,817,009 34
And the State tax.....	463,512 91
	4,280,522 25
Leaving net earnings.....	\$3,771,918 21
	\$1,348,701 35
The earnings of the leased lines in Iowa were.....	
Which, deducting the working expenses..	\$834,910 28
Rent.....	543,328 93
And taxes.....	19,532 91
	1,387,772 12
Shows a deficit of.....	\$39,070 77

In working the Iowa lines, and reduces the net earnings of all the lines operated by the company, to..... \$3,732,847 44
Against net earnings in 1870..... 3,857,321 80
A falling off in 1871, of..... 124,474 36

Making the proportion of expenses and taxes to gross earnings..... 61 per cent.

The total receipts from freight transportation in Illinois, show a gain of \$128,084.20 over those of 1870.

The net earnings over the Chicago, Burlington & Quincy Railroad, under the contract of 1867 show a falling off, as compared with 1870, of \$103,728.87, which is chiefly due to the lighter traffic from the Iowa lines. The Toledo, Peoria & Warsaw contract yields a gain of \$36,951.57 over the earnings of 1870.

19,372,210 bushels of grain were forwarded from stations in Illinois, and 4,684,590 bushels from stations in Iowa upon our lines.

Of this quantity, 18,796,100 bushels were received at Chicago, and 2,362,140 bushels at Cairo; 89,386,000 feet of lumber were forwarded from Chicago, a falling off of 32,934,000 feet as compared with the shipments of 1870.

The total quantity of freight transported in 1871 was 1,831,944 tons, equal to 262,150,386 tons hauled one mile, which yielded an average revenue of 2 32-100 cents per mile. In 1870, 265,409,371 tons were hauled one mile at the rate of 2 31-100 cents per ton; in 1869 the receipts were 2 48-100 cents per ton per mile.

The passenger service in Illinois shows a loss of \$232,929.69 from 1870, a part of which is attributable to a reduction made in the tariff in August last.

The loss of records prevents the usual full reports of the freight and passenger departments.

The reports of the General Superintendent and Chief Engineer, to which you are respectfully referred, show in detail the working of the line.

The profits of this railway depend largely upon cheap transportation to the seaboard. At the present moment this is controlled by three trunk lines of railway, which by means of their extensions, by leases, and traffic arrangements with new railways, cover the larger portion of Illinois, Iowa and Missouri. During the winter months they are overburdened with traffic, obliging the local western lines to await their convenience in taking freight. These railways have been extended during the past five years with unparalleled rapidity, without a corresponding increase of the capacity of the trunk lines. At this season they give direct rail transportation from Central Illinois to the Atlantic States at the same cost as obtains from Chicago.

The interest of the trunk lines is adverse to legislation by the General Government or by the State of New York, tending to an improvement of the canal system. Scarcely any reduction in time, or cost of transportation by the New York canals has been effected, while on other canals the adoption of steam power for towage has proved eminently successful.

The interests of this railway are closely identified with those of the city of Chicago, its terminus on Lake Michigan, in securing a return to the water route of the products of this State in transit to eastern markets. Until a more liberal policy is obtained with reference to the canal improvements, we must sensibly feel the loss of the control of the local traffic in Illinois, and be obliged, as we have been since 1866, to increase our tonnage and mileage of trains without a corresponding gain in net earnings.

The company lost in the October fire its passenger depot, freight depot, the land office, several small buildings and 26 freight cars. The loss on all the buildings, except the land office, was covered by insurance. Elevator A, on our station grounds, owned by private parties, was also destroyed, seriously crippling the grain receipts. The freight depot has been rebuilt. The building of a passenger depot is delayed, pending the determination of questions touching the title to lands conveyed by the Legislature of Illinois, in 1869, to this company,

the Michigan Central and Chicago, Burlington & Quincy railway companies, for a joint passenger station.

A contract has been entered into with the Gilman, Clinton & Springfield Railway, by which all its Chicago and New England traffic is to pass over this road, and fifteen per cent. of our gross earnings therefrom is annually, for a term of thirty years, to be set apart to be invested in its first-mortgage bonds.

We have substituted for the Chicago, Burlington & Quincy traffic agreement of 1867, one with that, the Chicago & Iowa, and the Chicago, Dubuque & Minnesota railway companies, under which we secure the eastern traffic of the latter line between Dunleith and Forreston, and a lower rate of toll between the main line and Chicago via Mendota and Forreston on all our northwestern traffic.

Negotiations pending at the date of the last annual report, for the extension to Cairo of the Southern railway system, have progressed so far that we anticipate being able to submit to the shareholders, at the May meeting, a plan whereby this desired connection will be secured at an early day.

It seemed desirable, in June last, to establish a fixed rental upon the Dubuque & Sioux City line, in lieu of the percentage paid under the present lease for twenty years; and it was agreed to submit this proposal to our shareholders at a special meeting in November. Circumstances prevented the proposed lease being submitted. The light crop in Iowa of the past two seasons, and the opening of competing railways, have resulted in a smaller traffic than was anticipated. The gradual settlement of the country on the Sioux City extension will yield a large increase of the traffic of this line.

The Land Department sold, in 1871, 48,927.31 acres of the lands donated to aid the construction of the railway for \$459,404.26, making the aggregate sales to the close of 1871, 2,215,789.77 acres for \$23,349,721.34, and leaving unsold at that date 379,210.23 acres; \$1,633,153.53 was collected, of which \$1,000,000 has been added to the construction bond fund.

The loss by fire of the Trustees' records, and of a part of the bonds delivered, prevent their further literal compliance with the terms of the construction mortgage. To protect the purchasers of lands, it has been deemed advisable to place at the control of the Trustees a sufficient fund to pay all the bonds. They had received, as shown by their statement of December 31, \$13,605,500 of bonds which have been canceled, or destroyed by fire. The construction bond fund amounting to \$2,630,000, now at their disposal, \$300,000 to be added this year, will, with interest accruing to the fund, pay the balance of the \$17,000,000 construction bonds.

You are referred to the annexed statements of the Treasurer, Auditor and Land Commissioner for a full exhibit of the accounts of the company. JOHN NEWELL, President.

Chicago, March 26, 1872.

The report of A. Mitchell, General Superintendent, gives the following statement of earnings:

	1871.	1870.
Freight.....	\$6,086,713 36*	\$6,142,530 63
Passengers.....	1,899,310 45	2,117,537 41
Extra baggage.....	3,477 42	4,014 71
Sleeping cars.....	29,889 00	31,674 00
Mails.....	113,212 00	97,672 25
Express.....	164,977 83	169,135 60
Rent of property.....	174,187 07	136,545 75
Dockage.....	4,506 84	8,511 00
Rent of engines and cars.....	21,361 69	19,185 56
Total.....	\$8,497,485 16	\$8,746,776 90

*\$518,479.94 is the gross amount of earnings over other roads, exclusive of leased lines.

The statement of expenses shows a decrease in all items except station expenses, maintenance of way, legal expenses and insurance; but has as new items "repairs of lake shore protection," "Cairo & Columbus transit steamer expenses," "Dunleith elevator expenses," and "loss and damage of freight by fire," amounting in the aggregate to \$69,012. The total decrease in operating expenses is \$117,088.19, and these expenses are 54.63 per cent. of the receipts.

The earnings of the Illinois lines were the merest trifle less than \$10,000 per mile; of the Iowa lines \$3,340 per mile; the working expenses in Illinois, about \$6,000; in Iowa, \$2,090; the proportion to receipts in Illinois being 60½ per cent., and in Iowa 62½ per cent., including taxes.

At the close of the year the company had 193 locomotives, 117 passenger cars, 45 baggage, mail and express cars, and 4,319 freight cars of various classes, besides 9 cars and 16 snow-plows used in construction and maintenance.

The capital account shows: capital stock, \$25,280,510; canceled bond scrip, \$16,370; bonded debt less construction-bond fund, \$5,764,500; bonds delivered Land Department, less in the hands of trustees, \$13,299,000; making the company's property represent \$44,360,380. The Land Department, however, has credits more than sufficient, to cancel the entire issue of construction bonds, and the funded debt whose interest and principal must be paid out of traffic earnings is practically nil, thus leaving the net earnings applicable for stock dividends, and 10 per cent nearly absorbs them.

The Massachusetts Commissioners' Report on Railroad Accidents: Their Frequency, Causes and Means of Prevention.

Returning from the consideration of the circumstances connected with the Revere accident which were peculiar to the Eastern Railroad, there were also certain other defects of management and causes contributing to that accident which seemed to be not peculiar to the Eastern railroad, but to exist in a greater or less degree upon most, if not upon all of the other roads of the Commonwealth. In saying this the Commissioners do not seek to imply that the Massachusetts roads are carelessly or incompetently operated as compared with other roads, either in this country or abroad. Such an impression would be erroneous in the extreme, as will be made very apparent in the course of this report. On the contrary, the Commissioners have been forced to conclude that the Massachusetts roads are very carefully operated, though on a system and with appliances which their business has in many respects outgrown, and without the full aid of many improvements which have been successfully adopted elsewhere.

Entertaining this belief, as soon as the earlier investigations into the Revere accident had been brought to a close, the Commissioners issued a circular to all the railroads of the State calling their attention to certain of the more immediate causes of that accident, and to the fact that similar causes, which might not immediately have led to similar disasters, existed in the manner of operating many other roads. They also invited the officers of the road to meet them with a view to conference, and to such consequent action as circumstances might seem to suggest.

In response to this call a large number of gentlemen, representing all the principal railroads of the State, met at the rooms of the Commission upon the 19th of September, and, after some discussion, at the request of the Commissioners they selected a committee of five from their number, consisting of the Hon.

John H. Clifford, President of the Boston & Providence, D. W. Lincoln, Vice-President of the Boston & Albany, D. L. Harris, President of the Connecticut River, J. B. Winslow, Superintendent of the Boston & Lowell, and William Merritt, Superintendent of the Boston & Maine railroads, to advise with and assist the Commissioners in preparing for submission to the several railroad companies recommendations as to changes in equipment and in the method of operating their roads best calculated to prevent the future recurrence of railroad accidents of this and all other descriptions. Having taken these preliminary steps the Commissioners began a careful examination, both into the most frequent causes of accident and the best appliances now known to prevent them. This investigation was long and difficult. In the course of it the Commissioners visited other States, consulting with many of the leading railroad men of the country, and personally examining their methods of operating their roads and the appliances in use on them. At the suggestion of members of the committee, they carefully collated the rules for operating their roads in use by all the corporations of the State, and compared them with those of several of the best-managed roads in other parts of the country. They also made a careful examination of all the accidents which had ever been reported as occurring in this Commonwealth—extending through the reports of twenty-five years—classified them and compared the result with such similar classifications as they could procure from the records of other countries. This last branch of their investigations enabled the Commissioners to effect a comparison between the safety of traveling upon the railroads of Massachusetts and upon those of other countries. The results of this action on their part, and of their consequent discussions with the committee of officials, they have now the honor to submit.

It has been very constantly asserted and generally conceded as an established fact that, as compared with those of Europe, the railroads of America are operated with a peculiar disregard of human life. Not only in the foreign journals are such phrases as "periodical American railroad slaughters" constantly met with, but in the American press every disaster is followed by a series of assertions of which the following is a fair example: "It may safely be affirmed that there are more lives sacrificed in a year in any one of the large States of the Union by railway and steamboat travel than in all the European States combined." So fixed is this general impression that it was very recently asserted both in the press and at public meetings held immediately after the Revere accident, that a disaster of similar nature could not have occurred on the railroads of Europe.

It seemed very necessary to ascertain at the outset of the investigation whether this generally accepted statement was well founded. If it should prove to be so, it would very clearly involve the necessity of an immediate revision of our laws under which penalties are visited on those guilty of even this comparative recklessness of human injury. It is, however, somewhat difficult to effect the necessary comparison in order to establish the facts of the case. While regular and carefully prepared statistics on the subject have for a series of years been published by several European governments, almost nothing of the kind can be obtained relating to American railroads. Massachusetts has probably the least imperfect body of returns on the subject to be found in this country. Such as they are these stretch over twenty-five years of railroad experience, but they are very far from being complete, nor are they sufficiently precise in their statements of fact. They begin with the volume of returns for 1847, and in presenting a report accompanying that volume, the joint committee on railroads took occasion to say: "The committee have reason to believe that the return of accidents is very incomplete. They have the best reason for saying, that many accidents have occurred of which no notice is taken by some of the corporations in their returns."

The experience of the Commissioners, as will hereafter appear, affords some ground for concluding that this criticism is applicable to the more recent as well as the earliest returns. The Commissioners have no reason to suppose that the statistics published year by year in such other States of the Union as prepare any returns at all on the subject are any more reliable than those of Massachusetts; it is possible that they may be so, but there is no apparent reason why they should be; and, having no means of verifying them, the Commissioners have not been willing to accept them as accurate. Neither could they succeed in obtaining any statistics upon this subject from the companies organized to insure travelers against injury from accidents. Either these associations conducted their business on a very vague calculation of chances, or they were unwilling to impart their information; but they professed themselves wholly unable to give the Commissioners any assistance in their investigation. The most diligent inquiry seemed finally to indicate that no body of information had ever been collected respecting American railroad accidents, and also that the materials for making it, so as to include the whole country, no longer existed. The investigation was, therefore, necessarily limited to the experience of Massachusetts alone.

The most obvious basis of comparison, and the one almost invariably adopted, is that between the whole number of casualties occurring within any given period of time and the whole number of those transported within that time by rail. In arriving at this basis, it is in the first place necessary to separate travelers from employees, and in the second place necessary to discriminate between accidents happening to travelers from their own carelessness, and those arising from causes over which they could exercise no control.

The limited extent of the railroad system of Massachusetts necessarily makes its returns for any one year, even when carefully verified, an insufficient basis from which to generalize; it becomes necessary, therefore, to base anything like a fair comparison on the experience of a series of years. The ten railroad years immediately preceding the time at which the investigation commenced were selected—the years between 1861-1870. A careful examination of the returns at once raised grave doubts as to completeness. Only fourteen passengers out of a total of 199,188,491 carried were reported during those ten years as having been injured by causes beyond their own control, and yet the same returns indicated the occurrence of no less than seventeen train accidents. Such a result as this would be unparalleled so far as the Commissioners are advised in railroad annals. It was in any case necessary to verify the result before basing any comparison upon it. A circular was accordingly prepared and forwarded to the officers of the several companies, calling for a statement of the whole number of cases in the ten years specified in which any sum of money had been paid to passengers, as the result either of proceedings at law or of voluntary compromise, on account of personal injuries received. The answer to this circular disclosed the fact that the corporations had, during the period named, paid an indemnity in no less than one hundred and thirty-five cases of death or personal injury, instead of in fourteen as appeared by the returns. The Commissioners were perfectly aware that the test applied to the Massachusetts roads in this case was a very severe one, and one which, as supplying a basis of comparison between them and the roads of other countries, was hardly just. Damages are not infrequently paid by corporations in order to avoid litigation, both in cases where the injury was in some degree occasioned by the act of the passenger himself, and where it is of such a slight nature as not to deserve to be made the subject of an official return. Among cases of this description reported in answer to the circular, was one where a woman was injured while leaving a train in motion, but she was very poor and the corporation paid her on account of her injuries; in another case of a very narrow escape from an accident similar to that at Norwalk in 1853, a great number of passengers were wet and very badly frightened, though sustaining no personal injury properly so called, but the corporation paid them rather than stand suit; in yet other cases the injury sustained seems to have been in-

dennified by payments as small as five dollars. If arrived at through a similar process, the accidents returned as happening to passengers from causes beyond their own control on European roads would be greatly increased. For instance, in one country (Belgium) in 1867, the whole number of such accidents on the state railroad was returned at three, out of a total of fifty-four accidents to strangers from all causes, but in this the official report stated that the administration, though it would have been justified in denying all responsibility in the great majority of cases, had yet in most cases made payments of money, to which the public treasury was not legally bound. The Commissioners wished, however, to make the comparison as severe as possible to the Massachusetts roads, so that no question could possibly be raised as to the accuracy of their conclusions in this respect. They accordingly accepted the basis of comparison supplied by the answers to their circular, rejecting only the particular cases in which it was obvious that the injury was of a trivial nature, or was occasioned by circumstances over which the party injured had some control. The subjoined table shows

cases of death and injury among passengers from causes beyond their own control rose to 1 out of every 256,752 passengers carried, even in this year the average journey resulting in death was 12,400,000 miles, and that resulting in either death or injury was over 3,900,000 miles.

So far from indicating, therefore, either carelessness or disregard of human safety on the part of the railroad corporations in operating their roads, the most perfect statistics would seem decidedly to negative any such inference. It is of course impossible to wholly prevent the occurrence of accidents on railroads. The utmost care and skill can only reduce them to a minimum, while anything like neglect will increase them indefinitely. The railroad system is but a human agency for the transportation of persons and property, and the safety of that which is transported depends upon an infinite variety of conditions of every conceivable nature, from the state of the atmosphere to the strength of a nail. A positive derangement of any of these conditions, dependent as they all are upon natural and human agencies, may lead at any moment to disaster. In con-

tail it would seem that, making every reasonable allowance for the imperfection of statistics, the amount of deaths and personal injuries of every description and arising from all causes annually incident to the operation of the railroad system of Massachusetts does not materially differ from that experienced in European countries.

As regards the causes of accidents also, the commonly received idea that a certain description of railroad disasters, generally those of a most distressing character, are peculiar to America, does not seem sustained on a more careful investigation. As will hereafter be seen, the causes of accidents in all countries are very similar. As regards the Revere accident, for instance, reference has already been made to the assertion, frequently made immediately after its occurrence, to the effect that such an accident could not possibly have occurred in Europe. How unwarranted this assertion was is made apparent by the following facts. It will be noticed that in the statement of Captain Galton, the railroads of France are pre-eminent for their freedom from accidents. On the 4th of September, however, on the *chemin-de-fer du Nord*, an "omnibus" train, 50 minutes behind time, was run into at a station called Sedlin, near Lille, by the Paris express, and three of its cars were completely demolished. The "omnibus" or accommodation train, was in this case in the act of being switched on to a siding, the express train was moving at a high rate of speed at the moment of collision, the steam escaped from its locomotive, and the debris of the cars caught fire. Nine passengers were killed on the spot, 75 were very seriously injured, generally by scalds and burns, a number of whom subsequently died; the merely bruised were not enumerated. The accident was caused by the failure of an employee in charge of a semaphore signal to give the necessary notice that the track was closed.

On the 13th of December, 1871, the "tidal" express train from Paris to Boulogne with London passengers, while going at full speed ran into a locomotive which was "manoeuvring," as the report expressed it, upon the track, near Chantilly. Both locomotives were destroyed, and seven employees and twelve passengers were injured. Both of these accidents, it will be noticed, have happened since the occurrence of the collision at Revere.

The following extracts from the very valuable report of Capt. H. W. Tyler to the Secretary of the Board of Trade on railway accidents in England in 1870, affords conclusive evidence that disasters like that at Revere are not unknown in Great Britain:

"As four London & Northwestern excursion trains were returning from a volunteer review at Penrith, the fourth, came into collision at Penrith with the third of those trains. One hundred and ten passengers and three servants of the company were injured; * * * the regulations for telegraphing the trains were altogether neglected."

"A passenger train, following close upon another passenger train, came into collision with it at Brighouse, in the absence of a better system for securing intervals of space between the trains, and of better accommodation at the station for a very crowded traffic. One passenger was killed, and nineteen passengers and one servant of the company were injured. The results would have been far more serious if the running train had not been provided with continuous brakes."

"A London & Northwestern passenger train came into collision at Ashton with part of a Lancashire & Yorkshire goods train which was being shunted. * * * Three passengers were injured. * * * There was a want of looking apparatus at a junction passed, 'on the Lancashire & Yorkshire line alone,' by 270 regular trains in the twenty-four hours."

"An auxiliary mail train, approaching the Carlisle station at an incautious speed, with all signals lowered, came into collision with an empty passenger train standing on the platform. Twenty-six passengers were injured. * * * There were only three brakes out of 26 vehicles in the train."

"A fast passenger train from Liverpool to Manchester came into collision in a fog with a Tydesley passenger train which preceded it * * * six passengers were injured."

"An express passenger train from London came into collision at Harrow with a portion of a goods train, which had been delayed by the fracture of a coupling. Seven passengers and one servant of the company were killed, and forty-one passengers and three servants of the company were injured."

"A passenger train from Manchester to Bowden came into collision, at Altrincham, with a combined train about to leave that station for Northwich. Eighteen passengers were injured."

"A passenger train from Paddington to the city overlook and came into collision with a preceding passenger train at the King's Cross station. Twelve passengers injured. * * * The block interval was thus reduced from five-eighths of a mile to 76 yards. * * * There were 469 trains, including both directions, passing King's Cross station daily."

"A passenger train from Derby to Ripley came into collision near Derby in a fog with a passenger train from Derby to Manchester. Twenty-five passengers and four servants of the company were injured. * * * The block telegraph system had been abandoned, as 'inconvenient and almost impracticable' on this portion of the line."

Those given above are a few of the cases classified in Captain Tyler's report under the head of "Collisions between Engines and Trains following one another on the same line of rails, or at Stations or Sidings." Under this head were returned 61 accidents for the year 1870 alone, resulting in 14 deaths and 592 cases of injury.

The ascertainment of the comparative degree of safety in traveling on the railroads of Massachusetts and those of other countries was not, however, the end the Commissioners had in view in entering upon their investigations. They have no desire to underestimate or to defend any shortcomings or defects in management which may exist on the roads of the State; they have, in fact, rather been charged with unduly magnifying everything of the sort. The only useful result to be arrived at through their inquiries was the attainment of a greater degree of positive safety; to accomplish this it was necessary to form some reliable opinion as to what additional precautions against accident could usefully be adopted. An examination and consequent classification of accidents could alone supply a basis for action on this point. The Massachusetts returns contain an incomplete record of the accidents of the last 25 years. The statements in the several cases are so very meagre that they do not supply the material for a satisfactory analysis of causes, but the accompanying table contains as perfect a classification in this respect as it was found practicable to make. (Table No. 4.)

The review of the railroad history of Massachusetts necessarily made in the preparation of this table conclusively established the fact that it was singularly free from the record of serious train accidents.* The following are in fact the only

* The following are a few of the more disastrous railroad accidents which have occurred in this country during the last twenty years: May 6, 1853. The Norwalk Bridge accident. Forty-five persons killed and some thirty injured.

July 8, 1854. A collision between an excursion train of twelve cars and an accommodation train took place on the Baltimore & Susquehanna Railroad. The excursion train was being pushed at the time of collision by its locomotive, and some six cars were crushed. Twenty-nine persons killed and over fifty injured.

October 27, 1854. A passenger train from Niagara on the Great Western Railroad of Canada ran into a long gravel train backing toward it. Forty-seven persons were killed and some sixty injured.

August 29, 1855. A passenger train on the Camden & Amboy road while backing ran into a wagon, and the four last cars of the train were thrown down an embankment. Twenty-five persons were killed and some sixty injured.

November 1, 1855. An excursion train of eleven cars on the Pa-

TABLE No. 2.

RAILROADS.	No. of Passengers Carried.	Number of Accidents.	PROPORTION TO WHOLE NUMBER OF PASSENGERS CARRIED.				
			Killed.	Injured.	Killed—1 in	Injured—1 in	Killed and Injured—1 in
Berkshire.....	177,816 ¹⁰	..	..	..	..	..	..
Boston & Albany.....	32,885,402	1	2	..	16,442,701	16,442,701	..
Boston, Clinton & Fitchburg.....	7,542,135	..	..	..	..	..	..
Boston, Hartford & Erie.....	9,786,179	..	13 ¹¹	..	722,783	722,783	..
Boston & Lowell.....	26,758,477	1	5	30 ¹¹	3,351,695	891,949	794,528
Boston & Maine.....	17,713,677	1	1	..	17,713,677	17,713,677	..
Boston & Providence.....	1,618,014	..	..	..	..	..	..
Cape Cod.....	1,007,535	..	..	..	..	..	..
Cheshire.....	5,835,941	..	..	..	..	..	..
Connecticut River.....	24,930,157	2	39 ¹¹	..	1,941,980	1,941,980	..
Eastham.....	560,685	..	..	..	639,534	639,534	..
Fairhaven Branch.....	543,605 ¹¹	..	..	..	..	..	..
Fall River, Warren & Providence.....	12,763,569	..	..	..	..	..	..
Fitchburg.....	134,134 ¹¹	..	..	..	..	..	..
Hanover Branch.....	4,089,350 ¹¹	..	..	..	..	..	..
Hartford & New Haven.....	1,597,486 ¹¹	..	..	..	..	..	..
Lexington & Arlington.....	305,236	..	..	..	..	..	..
Middleborough & Taunton.....	4,596,693	..	..	..	..	..	..
Nashua & Lowell.....	1,598,263	..	..	..	..	..	..
New Bedford & Taunton.....	825,193	3	10	..	82,519	82,519	..
New Bedford & Northampton.....	2,613,983	..	..	..	..	..	..
New London Northern.....	2,663,996	..	..	..	..	..	..
Norwich & Worcester.....	17,819,867	2	6	..	2,969,978	2,969,978	..
Old Colony & Newport.....	10,085,884	..	..	..	..	..	..
Providence & Worcester.....	515,775	..	..	..	..	..	..
South Reading Branch.....	1,946,436	..	..	..	..	..	..
South Shore.....	83,370 ¹¹	..	..	..	..	..	..
Stockbridge & Pittsfield.....	954,895	..	..	..	..	..	..
Stoughton Branch.....	1,753,367	..	..	..	..	..	..
Taunton Branch.....	1,809,539	2	3	23 ¹¹	603,173	78,674	69,596
Vermont & Massachusetts.....	4,150 ¹¹	..	..	..	..	..	..
West Stockbridge.....	2,439,542	..	..	..	..	..	..
Worcester & Nashua.....	199,338,386	16	8	147	24,904,048	1,568,709	1,475,795

¹ Includes Boston & Worcester, Western and Pittsfield & North Adams railroads.

² Includes Fitchburg & Worcester and Agricultural Branch Railroads.

³ Includes Norfolk County and New York & Boston Railroads.

⁴ Includes Lowell & Lawrence, Salem & Lowell, and Stoneham Branch Railroads.

⁵ Includes Essex & Rockport Railroad.

⁶ Includes Stony Brook Railroad.

⁷ Includes Hampshire & Hampden Railroad.

⁸ Includes Amherst, Belchertown & Palmer Railroad.

⁹ Includes Easton Branch Railroad.

¹⁰ For four years only.

¹¹ Eight years.

¹² Two years.

¹³ Nine years on road in Massachusetts only; one year on whole road.

¹⁴ Nine years.

¹⁵ One year only.

¹⁶ One year only.

¹⁷ Seven in one accident.

¹⁸ All in one accident.

¹⁹ Thirty-two in one accident.

²⁰ All but one in one accident.

the number of accidents happening in the ten years, 1861 to 1870, inclusive, on the several roads, the whole number of persons transported and the proportion of cases of injury to that number. (Table No. 2.)

It remains to effect a comparison between the results thus arrived at and those deduced from the returns of foreign roads. In their last annual report, the Commissioners referred to the statement of Captain Douglas Galton, made in 1862, in a paper on "Railroad Accidents," read before the Institute of Civil Engineers,* to the effect that "the returns of the 'Messageries Impériales' (stage-coach company) show, that in a series of years the number of passengers killed and injured, from causes beyond their own control, was 1 in 26,000; while from the latest comparative returns of railway accidents, the number of passengers killed and injured from causes beyond their own control would appear to have been on British railways, 1 in 334,000; on Belgian railways, 1 in 1,600,000; on Prussian railways, 1 in 3,000,000; on French railways, 1 in 4,000,000." A more careful examination of the various authorities within their reach has satisfied the Commissioners of the substantial correctness of the averages here given. As compared with the countries specified and averaged over a number of years, it would then appear that the casualties on the railroads in Massachusetts were 1 passenger killed in each 24,904,048 passengers carried; 1 passenger injured in each 1,568,709 carried; and 1,475,795 passengers are carried to each passenger either killed or injured. Or, bringing the figures of the several countries into direct comparison, the returns would indicate that among passengers carried on the railroads of the several countries there are killed and injured on

British railroads, one in..... 490,000;
Massachusetts railroads, one in..... 1,475,000;
Belgian railroads, one in..... 1,600,000;
Prussian railroads, one in..... 3,000,000;
French railroads, one in..... 4,000,000.

The average length of each journey made by rail in Massachusetts is reported at 19 miles; it would accordingly appear that upon a calculation of average chances any given person would accomplish 24,904,048 journeys of 19 miles each, or an aggregate journey of 334,000,000 miles, before meeting with any accident resulting in death, and 19,000,000 miles before meeting with any resulting either in death or in personal injury.

Even during the year 1870-71, the most disastrous year as regards railroad accidents in the annals of the State, when the

* Minutes of Proceedings, Vol. 21, p. 263.

† Captain Galton adds: "The greater comparative safety of foreign over British railways can be clearly traced to differences in the conditions of the traffic and management, and in the habits of the people, which lead them to allow the convenience of the railway companies to be consulted in the running of the trains, before that of the traveling public."

It is important to bear this unquestionably correct limitation in mind in discussing accidents on the railroads of this country. The traveling public of America in their demands for speed and comfort compel the railroads to take risks which are never taken on the Continent of Europe. Neither would our people submit for a moment to the restrictions enforced on the German or French roads. It is only with the railroads of Great Britain that any fair comparison can be made.

‡ The English method of computing the journey of season-ticket passengers differs from that used in Massachusetts. The figures given by Captain Galton are changed to make the necessary allowance for this variation of returns.

cluding this part of their report, therefore, the Commissioners feel constrained to say that, instead of charging the railroad companies with habitual recklessness, the result of their investigations has led them to regard the combination of speed and safety with which human movement is kept up by rail as perhaps the most remarkable result accomplished through an unceasing exercise of human care, skill and foresight which has ever come within their range of observation.

Apart, however, from accidents occurring exclusively to passengers and from causes beyond their own control, a similar popular impression also exists as to the reckless management of American railroads as regards employees of corporations and the public other than passengers. The Commissioners have also to a certain extent investigated this subject, and the result of their examination has tended somewhat conclusively to show that the generally received conclusion is as erroneous in this respect as in the other. The material for a comparison of a very unreliable nature between the results on this point reported on the state railroad of Belgium, the railroads of Great Britain and those of Massachusetts is supplied in the accompanying table. (Table No. 3.) The figures in this table relating to the Belgian road probably set forth the exact and complete facts

TABLE No. 3.
STATE RAILROAD OF BELGIUM.

	Employees.		Strangers.		Total of Casualties.	Whole No. of Passengers carried to each casualty....	Miles of road operated to each casualty....		
	Killed.	Injured.	Total....	Killed....				Injured....	
1866.....	43	67	109	24	35	59	168	69,370	2.93
1867.....	34	62	96	36	18	54	150	84,113	3.56
1868.....	30	65	95	25	87	68	157	81,683	3.42
1869.....	33	39	62	27	28	55	117	116,043	4.58
RAILROADS OF GREAT BRITAIN.									
1866.....	100	81	181	116	553	699	850	323,829	16.39
1867.....	105	100	205	104	695	799	1004	326,563	14.19
1868.....	83	65	148	129	535	664	812	374,753	17.00
1869.....	151	148	299	170	1084	1254	1553	190,446	9.75
RAILROADS OF MASSACHUSETTS.									
1866.....	30	9	39	51	25	76	115	199,407	12.13
1867.....	28	7	45	76	13	89	184	176,570	10.56
1868.....	27	6	33	71	15	86	119	209,378	12.06
1869.....	32	15	67	70	27	97	164	171,502	8.89

in the case. Those relating to the British and Massachusetts roads are manifestly imperfect, but the best which can be obtained. So far as any reliable inference can be drawn either from Table No. 3 or from an examination of the returns in de-

* During the ten years examined by the Commissioners, in which eight deaths were occasioned by train accidents on the whole railroad system of the State, there were, in the city of Boston alone, 1,663 deaths from accident, besides 73 homicides and 93 deaths from sunstroke.

† During the year 1870, the proportion of passengers killed and injured on the railroads of Great Britain, from causes beyond their own control, computed on the basis of returns used in Massachusetts, was one in every 372,000.

cases of the sort which seem to have resulted in any considerable loss of life or infliction of personal injuries.

1. November 6, 1847. By the falling of one end of a brake a car was thrown off the track of the Boston & Worcester road in Brookline and was crushed against the abutment of the bridge. Six persons were killed and four or five seriously injured.

2. November 3, 1848. A collision of extra trains took place at Marblehead Junction on the Eastern Railroad. Six persons were killed and some thirty-three injured.

3. January 6, 1853. A car of the Boston & Maine road at Andover was thrown from the track by the breaking of an axle. Three persons were killed (one the only son of President Pierce) and several were injured.

4. August 12, 1853. A collision occurred between an excursion and a regular train near Valley Falls on the Providence & Worcester road. This accident, properly speaking, did not take place in Massachusetts. Thirteen persons were killed and some twenty-five injured.

5. September 11, 1856. A passenger train was thrown from the track near Reading, on the Boston & Maine road, through the breaking of one of the axles of the tender. Four persons were killed and a number injured.

6. October 26, 1860. The rear car, containing some thirty passengers, of the steamboat express, on the Old Colony & Fall River road, was thrown from the track near Assonet, while moving at the rate of 35 miles an hour, was capsized and dragged on its side nearly a quarter of a mile. No one was killed; three persons were seriously, and a number were slightly injured.

7. September 17, 1862. A collision between an excursion and a regular train took place in Wrentham on the Eastern Railroad. One person was killed and some thirty-two persons were injured.

8. November 21, 1862. The Reading passenger train on the Boston & Maine Railroad ran into the draw of the bridge over Charles River. Six persons were killed and thirty were injured.

9. January 10, 1864. A car was thrown off of the track of the Boston & Lowell road near College Hill. No person was killed; fifteen persons were injured.

10. June 16, 1869. A passenger train was thrown from the track on the Vermont & Massachusetts road in Athol and was precipitated into Miller's River. Three persons were killed and twenty-two were injured.

The examination of the Commissioners, however, disclosed the somewhat interesting fact that three accidents of a precisely similar character and accompanied by the same circumstances, except as regards loss of life and personal injury, had in this State preceded the Revere collision.

The first of these took place on the morning of the 28th of March, 1850, on the Boston & Lowell Railroad in the town of Medford. The engine of an accommodation train which left Boston at 7:05 a. m. met with a slight accident and was obliged to stop for repairs. A severe snow storm was prevailing at the time and the 7:30 express train from Boston overtook the accommodation train and collided so violently with it that the engine of the latter train stove in the rear car of the former train, stopping inside of its shell. The alarm had in this case been given in time and most of the passengers, few in number, escaped; two only were seriously injured, and the fireman of the colliding train, in jumping off to save himself, so injured his arm that amputation was necessary.

The second of these accidents occurred on the Fall River road on the evening of November 21, 1853. The steamboat express was disabled by the breaking of the axle of a second-class car and obliged to stop. An accommodation train was following it, but, though the conductor of the disabled train hurried back to give notice of danger, owing to the foggy state of the atmosphere his signal was not seen in time, and a collision ensued of such violence that the colliding locomotive and most of its tender were buried in the rear car. The steam at once escaped from the boiler, and of the few passengers in the car one was killed and a number more or less injured, principally by scalding.

The third of these rear collisions took place on the Salem & Lowell road on the 27th of August, 1864. This road was operated jointly by the Boston & Lowell and the Eastern companies. As a Boston & Lowell train was passing Fry's Mills, near Salem, it encountered a load of hay entangled at a grade-crossing. The train stopped, and very shortly afterward the Lawrence train of the Eastern company followed round the curve, striking the train so forcibly that the locomotive ran half its length under the Lowell cars. Several were injured in this accident but no one was killed.*

The most remarkable feature in the classification presented in Table No. 4 is the very small proportion of casualties for which the companies are responsible as compared with the large proportion directly attributable to the recklessness of the persons injured. Forty-five per cent. of all the accidents examined, resulting in 835 deaths and 235 cases of injury, or 39 per cent. of the whole aggregate of killed and injured, fell under the two headings of "Unlawfully or carelessly on track," and "Getting on or off trains in motion," these two headings, with

the Railroad of Missouri, on the occasion of the opening of the road, was crossing the bridge over Gasconade River when the bridge gave way, precipitating the train thirty feet into the water. Twenty-two were killed and some fifty injured.

July 17, 1856. A collision took place on the North Pennsylvania road between an excursion train of ten cars, containing some five hundred children with their teachers, and a regular train. Five cars were burned, sixty-six persons were killed and over one hundred injured.

March 12, 1857. A locomotive ran off the track of the Great Western Railroad of Canada while approaching the bridge over the Des Jardines Canal. The train fell through the bridge and crushed through the ice into 15 feet of water. Sixty persons were killed and a large number wounded. In this case it was thought that a self-coupler would have saved the rear cars of the train, which were, however, both linked and chained to the forward cars and were dragged over by them.

June 17, 1858. A passenger train on the Erie road, near Port Jervis, encountered a broken rail. The last two cars were thrown from the track and precipitated down a 30 foot embankment. Six persons were killed and fifty injured. In this case had the coupling held no injury to person would have been sustained. The cars ran 25 rods after derailment, before the coupling broke.

June 27, 1859. A passenger train on the Michigan Southern road was precipitated into a rivulet near South Bend by the giving way of a culvert. Thirty-four persons were killed and some fifty injured.

April 14, 1867. A night express train was thrown from the track at Carr's Rock on the Erie Railway, by a broken rail, and rolled down an embankment. Twenty-four persons were killed and eighty injured.

February 6, 1871. A night express train on the New York Central & Hudson River road was thrown from the track on a bridge near New Hamburg by a collision with an oil car. The locomotive and one or two cars were precipitated through the ice and others set on fire. Twenty-one persons were killed and a large number injured.

* A similar accident took place on the Housatonic road on August 16, 1865, but not within the State of Massachusetts. A new engine, out on an experimental trip, ran into the rear of a passenger train which was at the time backing toward it. In this case the colliding locomotive ran wholly through the rear car and into the one next to it, where its boiler burst. Eleven persons were killed, and some seventeen badly injured by crushed or scalding, etc.

An accident precisely parallel to that at Revere occurred at Bristol, N. J., upon the Camden & Amboy road, on March 7, 1865. The Washington express for New York ran into the rear of a Kensington & New York train which was two hours behind time. In this case the express train was going at a high rate of speed, and its engine shattered to pieces the rear car of the preceding train, and buried itself in the next car. The steam escaped, the cars caught fire, and ten passengers were crushed, scalded or burned to death, while some forty were injured.

certain facts connected with the heading "Striking overhead bridge," will sufficiently illustrate this point.

The practice of unlawfully walking on the tracks of railroads has twice before been referred to in the reports of this Board. (Report 1870, p. 92. Report 1871, p. 25.) More deaths and cases of personal injury have arisen from this cause alone than from all the train accidents which have ever occurred in the State. The whole number of deaths from train accidents, properly speaking, has been 172, with perhaps 250 cases of injury; 570 deaths and 98 cases of injury are reported to persons walking on tracks, and this does not include 105 other cases (86 deaths, 19 injuries) to persons lying on the track, or the 195 cases (132 deaths, 44 injuries) of persons crossing the track in front of the locomotive; or the 14 cases of suicide. Not only is the practice very dangerous in itself, but it has always been forbidden by law (Gen. Laws, chap. 63, § 102). At the same time it is one which it is found impossible to prevent, either in this country or abroad. No less than 57 trespassers, for instance, as they are there called, were killed, and 9 were injured on the railroads of Great Britain and Ireland in the year 1870, 105 in 1869, and 45 in 1868. As a rule, no attempt is made in this country to enforce the law prohibiting the practice; certain roads have, however, at points where accidents most frequently occurred, undertaken to arrest trespassers and to enforce against them the penalties of the law. This action has excited so much hostility in the neighborhood that obstructions have immediately after been found placed secretly on the track. In attempting to protect trespassers, therefore, the corporations found that they were jeopardizing the safety of their own passengers and employees. In this case neither personal risk nor respect for the law suffices to restrain great numbers from a practice found to be somewhat convenient.

So also as regards entering and leaving trains in motion, or leaving trains on the wrong side. These are the second most fruitful cause of accident, resulting in 16 per cent. of the casualties. It is well nigh useless to pass laws or to attempt to enforce regulations wholly opposed to the habits of the community. The American people have always been accustomed to take care of themselves, and no law or regulation looking to their safe confinement in cars or in waiting-rooms, or prescribing on which side they should enter or leave trains could practically be enforced. If they could, the railroad corporations

was about 14 feet in the clear. The increased size of rolling stock rendered this insufficient and 18 feet was prescribed by law for bridges thereafter constructed (Acts 1868, Chap. 308). Meanwhile it was sought to provide for the safety of brakemen in passing under all bridges of less than the standard height by directing bridge-guards to be placed before them. These guards gave the brakemen notice of the proximity of the bridge and, though they at times injured them and frequently annoyed them by blows, yet in practice it has been found that they in a very great degree prevent the occurrence of this class of accident. It has, however, also been found on certain roads extremely difficult to keep these guards in use, owing to the fact that the brakemen themselves destroy them. They prefer to take their chance of death from the bridges, rather than to be continually annoyed by raps from the guards. The only absolute protection against this class of accidents would seem to be found in the erection of 18-foot bridges. Here, however, a new difficulty is to be encountered. These bridges are even more unpopular with those using the highways than are the bridge-guards, with brakemen. Bitter opposition is made to them on account of the increased strain they impose on all draught animals. As a consequence, whenever a new railroad is now constructed, or a new highway laid out, the residents in the vicinity almost invariably petition that the crossings shall be at grade; especially is this the case in all crowded neighborhoods and in the vicinity of Boston. Cases have recently come before the Commissioners, and others can be cited, where the advocates of new thoroughfares have refused to accept a bridge, even when it was urged upon them, and have preferred temporarily to give up the desired way rather than be subjected to the inconvenience necessary to preserve them from the dangers and certain disasters of a grade crossing. Within the last year corporations against their strongest remonstrance have had such crossings laid out across their roads in place of bridges and at very dangerous points of approach. The Commissioners are satisfied that some distressing calamity, which they are wholly powerless to prevent, must ultimately occur at certain crossings—as for instance at the Western avenue crossing in Brookline; but they greatly fear that nothing but such an accident will cause that remedy to be applied which soon or late must be applied, though at a cost greatly aggravated with each year of delay.

TABLE No. 4.

NATURE OF ACCIDENT.	Whole No. of Accidents.	EMPLOYEES.		PASSENGERS.		OTHERS.		Killed and Injured.
		Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	
<i>Cases attributable to carelessness of parties injured.</i>								
1. Unlawfully or carelessly on track.....	665	18	2	..	..	570	98	668
2. Attempting to get on trains in motion.....	292	18	7	89	45	81	15	298
3. Attempting to get off trains in motion.....	179	12	7	92	37	8	4	180
4. Falling from trains in motion.....	214	104	23	48	15	17	5	214
5. Crossing track in front of train.....	199	12	4	1	2	182	44	195
6. Lying on track.....	105	..	..	..	..	86	19	105
7. Leaving from train in motion.....	12	9	1	2	..	..	..	12
8. Crossing track under cars.....	6	..	..	..	..	5	1	6
9. Arm out of car window.....	5	..	..	..	5	..	..	5
10. Suicides.....	14	..	..	..	..	14	..	14
Total.....	1,591	173	46	229	184	863	186	1,621
<i>Cases attributable to causes which admit of control by government or management.</i>								
(a.) Defects of structure—								
1. Crossings at grade.....	96	..	..	..	..	69	80	149
2. Derailment at switch.....	7	5	1	..	..	..	..	9
3. Derailment by expansion of rails.....	1	..	..	1	26	..	..	27
4. Derailment by cattle.....	7	3	1	1	..	..	..	5
5. Derailment at junction.....	2	..	3	..	..	..	..	3
6. Striking overhead bridge.....	150	112	40	1	..	4	3	159
7. Giving way of a bridge.....	1	1	..	..	..	..	..	1
Total.....	273	121	45	5	27	78	82	255
(b.) Collisions—								
1. Collisions, head.....	23	14	21	26	89	2	2	154
2. Collisions, rear.....	4	1	1	39	59	..	..	93
3. Collisions on sidings.....	5	5	2	..	..	6	6	19
4. Collision of engines.....	1	1	..	..	..	..	..	1
5. Collisions at railroad grade-crossing.....	1	1	..	..	..	..	..	1
Total.....	44	22	24	56	148	8	8	268
(c.) Defects of rolling stock—								
1. Derailment from breaking of axle or wheel.....	10	17	7	9	16	..	..	49
2. Explosion of engines.....	19	20	1	..	..	1	1	23
3. Explosion of oil cars.....	3	3	..	..	..	1	..	3
4. Passing from car to car while train in motion.....	18	9	..	8	2	..	..	18
5. Falling between cars.....	31	12	4	8	4	3	3	33
6. Crushed by shifting or coupling cars.....	150	108	43	..	..	1	3	150
Total.....	224	163	65	25	22	5	7	276
(d.) Struck by engine while leaving car on wrong side.....	3	..	..	2	1	..	..	3
(e.) Falling of train through draw.....	2	1	..	5	4	..	..	10
<i>Cases attributable to miscellaneous causes.</i>								
1. Derailment of hand-car.....	2	4	2	..	..	..	..	6
2. Derailment by snow.....	2	2	..	..	..	..	..	2
3. Thrown from top of freight car.....	14	9	3	1	..	1	1	15
4. Thrown from hand-car.....	14	7	7	..	..	..	..	14
5. Thrown under gravel or freight train.....	9	6	1	..	..	2	..	9
6. Falling under engine.....	17	7	..	..	..	9	1	17
7. Concussion in sudden starting or stopping of trains.....	3	..	1	..	..	..	..	3
8. Thrown from platform by sudden starting.....	2	2	..	1	..	..	..	4
9. Killed while working on track.....	6	6	..	..	..	..	..	6
Total.....	70	43	14	2	3	12	2	76
Derailment from causes not stated.....	25	17	5	8	10	..	..	40
Miscellaneous.....	87	28	27	..	2	12	9	88
Whole number of accidents.....								2,319
Employees killed.....								577
Employees injured.....								216
Passengers killed.....								337
Passengers injured.....								338
All others killed.....								973
All others injured.....								294
Whole number killed and injured.....								2,735

would unquestionably be glad to adopt and enforce them. Under the circumstances, however, it would seem more reasonable to afford every appliance for safety in these respects, and then, within reasonable limits and after due notice of danger given, to leave people to take care of themselves.

Another striking illustration, in two respects, of the inherent recklessness both of individuals and of the community at large is furnished in the case of grade crossings and overhead bridges. Both grade crossings and bridges as they have hitherto been constructed have proved fruitful causes of death and personal injury; the one to travelers on highways, the other to brakemen standing on the top of freight cars. Of the two the overhead bridge has occasioned the greater number of casualties, there having been reported 117 cases of death and 42 of injury from this cause, to 69 deaths and 89 injuries from the other. The original height of bridges on Massachusetts roads

The opinion of the Commissioners on this point is perfectly well known and does not need to be repeated. Every grade crossing and every overhead bridge, less than 18 feet in the clear above the track, with absolute certainty involves, soon or late, death or personal injury to a given number of persons. Not only should no more of either in future be constructed, where it is possible to avoid them, but those already in existence should gradually be replaced. If, however, the majority of the community think otherwise, it is impossible for the Commissioners to effect any essential reform in this respect, especially as jurisdiction in the premises belongs not to them, but to the county commissioners. The alternative should, nevertheless, be distinctly understood; it is that the community accepts as the price of its unwillingness to submit to an inconvenience a certain regular percentage of casualties.

[TO BE CONTINUED.]